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ABSTRACT

This document presents a collection of energy conservation ideas gathered from a survey of Texas cities and via a national search of recent technical information. The conservation ideas presented are grouped into categories of: administrative concerns, public buildings, public vehicle fleets, transportation systems, municipal utilities, alternate energy sources, and other conservation options. Each conservation idea presented includes an information source from which more details pertaining to the idea may be obtained. (SL)

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Texas Conservation Guide for Municipal Services

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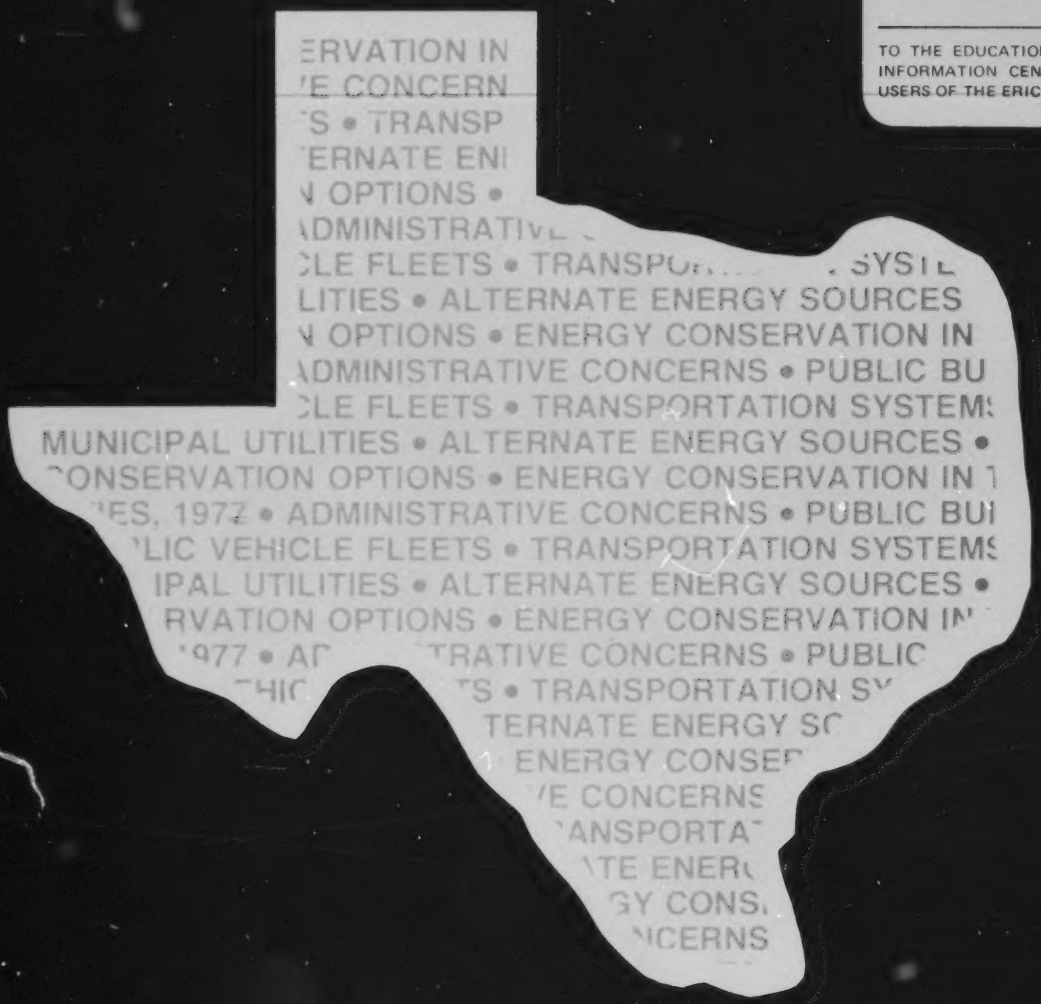

Institute of Urban Studies
University of Texas at Arlington

SE 023 467

TEXAS CONSERVATION GUIDE

FOR

MUNICIPAL SERVICES

Jacilyn G. Walker
Martha L. DeHaven
Research and Service Programs Division

A Report to Texas Cities

Institute of Urban Studies
The University of Texas at Arlington

Arlington, Texas
September, 1977

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Special thanks go to the many local government officials who took time from their busy schedules to complete the survey and provide even further details on their communities' activities when contacted later. Without them, there would not be a manual. Although space does not permit the listing of all local officials who contributed in some way to the final content of the manual, the authors are especially indebted to staff personnel in the cities visited during data collection: Rosebud, Jasper, Fort Stockton, Lufkin, Garland, Arlington, Wichita Falls, Austin, Fort Worth, San Antonio, and Dallas.

Special appreciation is expressed to Ms. Patti Allen for her expert secretarial support.

Finally, it should be stated that this report does not represent an official position of any agency, any official cooperating in the project, or The University of Texas System. Conclusions and data interpretations are those of participating Institute staff members, for which they accept full responsibility.

Jacilyn G. Walker
Martha L. DeHaven

Arlington, Texas
September, 1977

Introduction

IUS Energy Research

Rising costs, memories of the winter of 1976-77, and the strong energy emphasis of the Carter Administration are causing more local governments to search for sources of conservation information that specifically address the energy problems of municipal service delivery.

During the past several years, the Research and Service Programs Division, Institute of Urban Studies, The University of Texas at Arlington, has been deeply involved in energy studies with Texas local governments. Interest began in this area when, in 1973, discussions with local officials made Institute research personnel aware of the extremely serious fuel problems faced by cities and counties throughout the state. At that time, there was no agency or institution equipped to provide even basic information to communities seeking aid in alleviating the many "crisis" problems they faced.

In 1974, the Institute published Energy and Local Government, a statewide survey of Texas cities and counties to determine the impact of less abundant and more costly fuel. From the 290 respondents, it was learned that the 1973 energy crisis had an adverse effect on the service capability of 74 percent of responding local governments, with the severity of impact positively correlated to population size. The primary service areas affected were street construction and maintenance, law enforcement, and solid waste collection. City and county officials reported implementation of a number of conservation techniques used to reduce fuel consumption, including purchase of smaller vehicles, more effective vehicle routing, and the establishment of departmental gasoline allocation systems. In addition, several cities established citizen conservation committees and instituted public campaigns to emphasize conservation practices throughout the community.

The following year, another IUS publication examined in detail the inflationary effects of energy cost increases on municipal budgets in 20 diverse Texas cities. Entitled Energy and Local Government: The Price of Crisis, this study used computer-developed "municipal prototype models" to reflect price trends for major energy-related municipal supplies from 1970-75 and to permit local officials to compare report findings with experiences in their

own jurisdictions. The study found that fuel product costs represented a rapidly increasing proportion of total municipal expenditures, from a low 5.2 percent of total general fund expenditures in the base fiscal year 1970-71, to 11.3 percent in 1974-75. Such growth resulted from price increases in basic supplies that ranged from 33.1 to 198 percent for the years 1973-75. Faced with these spiralling costs, Texas cities had three alternatives for action:

- Increase taxes and/or service fees
- Selectively decrease the level of municipal services
- Implement comprehensive energy conservation programs for municipal services.

Texas Conservation Guide for Municipal Services

Still today, societal needs suggest that energy conservation - applied in a comprehensive manner - represents the best choice from both the viewpoint of the economy and the importance of delivering the broad profile of services required by modern living in urban and rural communities. While many reports have dealt in detail with technical options in energy use, the collection and assembly of such information into a viable, comprehensive program for energy conservation management at the local level has been attempted on a relatively disjointed, city-by-city basis. This lack of transferability to other cities has, itself, resulted in a large and repetitive expenditure of human and resource energy. Local governments without the available staff time or expertise to research and formulate their own conservation programs have become discouraged at the dimensions of such a task and, thereby, have missed opportunities for significant cost and energy savings.

Through this manual, staff members of the Institute of Urban Studies have attempted to respond to the need for a basic, compact source of up-to-date energy conservation information by Texas local governments. Conservation ideas were gathered from a survey of Texas cities as well as a national search for the most recent technical information. Because of the organizational variety found in Texas cities, these "conservation options" were then grouped into common functional areas for easy reference. Wherever possible,

contact personnel for specific techniques are listed to assist those cities interested in more detailed information. The findings of major energy research efforts and specific examples from Texas cities are presented in detail to highlight important conservation opportunities.

This report represents the initial research basic to the development and implementation of any comprehensive energy conservation management program in municipal services. The authors hope that local officials will find it an informative and useful planning tool.

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The Public Interest requires doing today those things that men of intelligence and good will would wish, five or ten years hence, had been done.

--Edmund Burke
Energy, The New Era, p. 328

I Energy Conservation in Texas Cities, 1977

13

I: Energy Conservation In Texas Cities, 1977

In 1974, the Institute of Urban Studies conducted a survey of Texas cities and counties that focused on their conservation responses to the oil embargo and resulting fuel supply problems. Some local governments at that time became deeply involved in conservation planning that was to continue into the coming years. Others responded to fuel problems on an ad hoc basis so that the initial emphasis on conservation in many jurisdictions quickly faded into the background with the lessening of crisis pressures.

This seemingly casual return to "business as usual" in municipal service delivery was not based on deliberate insensitivity to the nation's energy problems. The growing imbalance between energy supply and demand with related implications for all sectors of the economy has been a continuing concern among local government officials, especially when faced with the budget pressures of spiralling fuel and fuel-related supply costs. A more likely explanation is found in the confusion of the years immediately following the embargo, confusion in federal/state energy policy actions and in the often conflicting recommendations of a vast number of energy research reports.

Municipal Energy Conservation Survey

Almost four years have passed since the embargo was declared. The United States today imports about 42 percent of its petroleum supplies, an increase of some 9 percent over 1973 levels. Meanwhile, the debate continues as to the proper role and format of a comprehensive national energy policy. Of primary importance for Texas local governments is the steadily rising cost of those petroleum products and utilities commonly used in municipal service delivery - with even higher prices predicted for the future.

In light of this continuing local need to reduce costs and the major national emphasis on conservation as the most viable short-term alternative for extending petroleum resources, the Institute asked Texas cities what they had done about energy conservation since 1974.

The Municipal Energy Conservation Survey (see Appendix) was designed with

the aid and cooperation of the Texas Municipal League. Mailed to all Texas cities with a population of 2,500 or more as well as a selected group of smaller communities, the twofold purpose of this survey was: (1) to determine the extent to which Texas cities have developed or maintained active, comprehensive programs of conservation; and (2) to identify Texas cities with especially interesting or unique conservation programs. It is the belief of the project staff that the sharing of tested conservation techniques among Texas cities by means of this manual can be particularly helpful in meeting the need for more detailed information applicable to the specific social, economic, and physical realities of Texas life.

Survey Response

One hundred and sixty Texas cities (41.6 percent) responded to the conservation survey. Figure 1.1 presents a breakdown of respondents by population categories.

Figure 1.1

Survey Respondents
by Population

Population Category	Number of Respondents	% of Total Number resp.
Under 5,000	54	33.75%
5,000 - 11,000	42	26.25%
12,000 - 24,999	30	18.75%
25,000 - 74,999	24	15.00%
75,000 & Over	10	6.25%
Total	160	100%

Summary of Survey Results

Two types of questions were emphasized in the Municipal Energy Conservation Survey. The first (questions 1-4) dealt with very specific activities based on past IUS energy research in cities with especially active, successful

conservation programs. As shown in Figure 1.2, relatively few of the total 160 respondents had instituted these activities; the ten largest cities responding showed the greatest percentage involvement in each area. Population size may be a controlling factor in at least two of the activities specified: Energy Conservation Coordinators and Citizen Conservation Committees. Cities in the smaller population categories are less likely to have a scale of municipal operations that would require the appointment of an individual with overall responsibility for energy conservation. The two cities with populations under 5,000 that responded positively to this question reported their city managers as holding this responsibility. Likewise, smaller cities may find it more difficult to actively maintain a formal committee of citizens for conservation assistance. Informal consultations with local "experts" in specific areas of energy use (i.e., engineers, architects, utility representatives) may be a more common approach to small city energy problems.

Population may also limit a city's ability to receive federal grants-in-aid funds to assist local conservation efforts. Eligibility requirements sometimes specifically exclude small communities; intense competition for federal funds from larger cities with long experience in grant applications and project management may have the same overall effect. A more important factor here, however, is probably simply the small number of grants available to cities that in any way impact energy use. Of the five respondents reporting federal "energy-related" grants, two were for weatherization of homes, one to repair a dam, one to establish a carpool program, and one to transfer technology (including energy use technology) to cities.

The second type of question emphasized in the survey attempted to find out which general areas of conservation cities currently were most active in: buildings, police/fire departments, purchasing, etc. (question 5). Figure 1.3 presents the cities' responses.

Efficient operation of public buildings and public vehicles were the two areas most frequently checked (45 and 44.4 percent of all survey respondents, respectively). This result was expected since the many energy-consuming building systems and fuel costs for city vehicles are so clearly and frequently brought before all city administrators in the form of monthly utility and gasoline bills. Conservation in these areas has been the subject of much discussion since the 1973 embargo; that intense concern obviously continues today.

Figure 1.2

Respondents Reporting Policy Statements,
Energy Conservation Coordinators,
Citizen Committees, and/or
Federal Conservation Grants by
Population

Population Category	No. respondents per category	City Council Energy Policy Statements	Energy Conservation Coordinators*	Citizens Conservation Committees**	Federal Grants for Conservation
Under 5,000	54	0	2	0	1
5,000 - 11,999	42	0	0	0	1
12,000 - 24,999	30	1	1	1	0
25,000 - 74,999	24	1	4	0	1
75,000 & Over	10	3	3	3	3
Total	160	5	10	4	5
% of all Respondents	100%	3.125%	6.25%	2.5%	3.125%

* All Coordinators were city employees rather than volunteers

** All Citizen Committees were appointed rather than elected

Figure 1.3

Respondents Involved in Conservation Areas by Population

Conservation Area	Under 5,000	5,000-11,999	12,000-24,999	25,000-74,999	75,000 & Over	Total (% of all Respondents)
Comprehensive Energy Management planning	0	0	0	1	2	3 (1.9%)
Energy audits for buildings or services	1	1	4	6	5	17 (10.6%)
Computerized energy management information systems	1	0	0	0	2	3 (1.9%)
Employee participation	2	1	1	0	3	7 (4.4%)
Purchasing policies	6	5	6	5	3	25 (15.6%)
Periodic energy use reports by department	1	1	3	5	3	13 (8.1%)
Efficient operation of public buildings	22	18	11	12	9	72 (45.0%)
Efficient use of public vehicles	22	20	10	13	6	71 (44.4%)
Public works construction/ maintenance	7	5	2	3	1	18 (11.2%)
Efficient traffic control	2	4	5	5	3	19 (11.9%)
Police/fire department programs	5	9	5	4	2	25 (15.6%)
Community information and involvement	3	1	1	1	3	9 (5.6%
Alternate energy sources	0	0	1	0	2	3 (1.9%)
Utilities management	10	7	3	3	5	28 (17.5%)
Respondents checking no conservation areas	28 (51.9%)	20 (47.6%)	14 (46.7%)	8 (33.3%)	1 (10.0%)	71 (44.4%)
Total Respondents per category	54	42	30	24	10	160 (100%)

While there was some confusion around the area entitled "utilities management" (it being variously interpreted as keeping an eye on utility bills or operating municipal utility systems as efficiently as possible), the activity of 17.5 percent of all respondents here clearly points out the interest in the "utilities" area. Likewise, many cities (15.6 percent) are making some effort to purchase energy efficient supplies/equipment for municipal services.

The most disturbing finding of this survey was the high percentage of respondents - overall and in each population category except 75,000 and over - who checked no boxes when asked to indicate which areas of conservation they were actively involved in at present. Even allowing for some misunderstanding of the question, the 44.4 percent figure is still ominously high in view of the emphasis on conservation across the nation and in Texas for the last four years.

Survey Follow-Up

In addition to gathering data on the extent of conservation efforts, the Municipal Energy Conservation Survey was designed as a starting point for project team contact with cities reporting especially successful or unique conservation programs. In the second part of question 5, cities were asked to briefly describe any such program they were involved in; these responses led to many of the Texas city examples included in this manual.

On the basis of survey responses, 5-10 cities in each population category were contacted by telephone and asked to provide more details about conservation activity areas they had checked. This effort proved very fruitful. In fact, many local officials described conservation ideas they assumed "everybody else probably knows about" when, in fact, the activities were quite unique, innovative, and readily applicable to other cities' operations.

From these telephone contacts, appointments were made with at least one city per population category to further discuss conservation programming and problems. An effort was made to visit Texas cities in a number of different socio-economic and geographic situations so as to give the final report a variety as great as that of the cities it is intended to serve. These personal interviews and the concurrent nationwide literature search for conservation ideas applicable to municipal services turned up additional Texas cities with

a reputation for effective conservation activities which were also visited.

Conservation Management Findings

Two major points for any city interested in the effective management of municipal service energy conservation were continually re-emphasized during the survey and its follow-up. First, someone in the city management organization must have a real commitment to conservation. From the smallest to the largest city contacted for details on an effective energy use idea, there was always at least one person with some management authority who knew the value of energy savings and made a sincere effort to institute energy-conserving ideas in his/her area of responsibility. These people varied greatly in age, education, and experience; but they all made a conscious effort to keep up with new conservation ideas and apply them whenever possible.

Secondly, effective conservation efforts require the active support of local elected officials and the citizenry at large. Without such support, several city managers reported that they were forced to drop all but the most minor conservation options such as turning off lights and setting thermostats back. Other cities were struggling to develop and implement major conservation projects in the face of city council apathy, making the task doubly difficult. Those communities reporting supportive, actively involved elected officials were much more able to institute successful and growing conservation programs.

II Administrative Concerns

II: ADMINISTRATIVE CONCERNS

Purchasing

Conservation Option: Energy Efficient Standards

Energy efficient standards are simple policy requirements for the purchase of certain goods with minimum acceptable levels of energy efficiency. Care must be taken to design standards so as not to limit competition to overly expensive items or to reject more efficient products because of their slightly higher initial price.

In several states, energy efficiency standards have been adopted by statute and are emphasized further in administrative regulations. This practice, however, has a major drawback in terms of keeping the standard up-to-date with technical advances and/or legal restrictions.

A second method for keeping standards current is to tie the efficiency requirement to a valid external indicator that is not sensitive to periodic and regional market fluctuations. Congress used this approach in the Energy Policy and Conservation Act of 1975, 42 U.S.C., 6288 (1975).

> (a) The President shall, within 120 days after the date of enactment of this title, promulgate rules which shall require that all passenger automobiles acquired by all executive agencies in each fiscal year which begins after such date of enactment achieve a fleet average fuel economy for such year not less than
>
> (1) 18 miles per gallon, or
>
> (2) *the average fuel economy standard applicable under section 502 (a) for the model year which includes January 1 of such fiscal year, whichever is greater.*

Many local governments periodically require the purchase of some specialized, relatively inefficient item that would not be acceptable under a general energy efficiency standard. Therefore, administrative policies should either be applicable to the average energy efficiency of all items in a particular category (as in the previous federal example) or contain specific exemptions for specialized needs.

Example: Standards Using "EER"

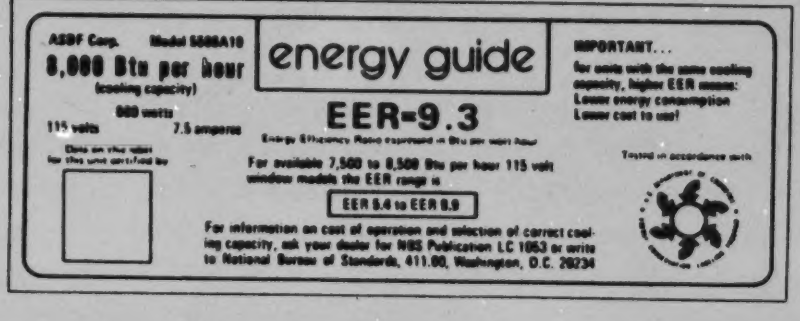
Standards may be used that specify a range for "EERs" (Energy Efficiency Rating). An EER is computed as follows:

$$EER = \frac{\text{BTU's of power produced}}{\text{Watts consumed in power production}}$$

Reliable tests for efficiency are currently available only for air conditioners. However, the Energy Policy and Conservation Act of 1975, 42 U.S.C., sec. 6292 and 6293 (1975), requires the National Bureau of Standards to develop efficiency tests for the following items: refrigerators and refrigerator-freezers; freezers; dishwashers; clothes dryers; water heaters; room air conditioners; home heating equipment, not including furnaces; television sets, kitchen ranges and ovens; clothes washers; humidifiers and dehumidifiers; central air conditioners; furnaces, and any other consumer product the Administrator of FEA classifies as a covered product.

Under the same act, the Federal Trade Commission was authorized to prescribe labeling rules for covered products. While these rules were not complete as of June 1977, some manufacturers of room air conditioners already use EER labels as shown in Figure 2.1, developed by the U.S. Department of Commerce under the 1974 "Voluntary Labeling Program for Household Appliances and Equipment to Effect Energy Conservation."

Figure 2.1



Courtesy of National Bureau of Standards

* * * * * * * *

City of Caldwell
(pop. 2,574)

Many Texas cities indicated in the survey that they were involved in energy-efficient purchasing. None of those contacted by phone or in person, however, had formal written policies requiring a certain level of EER, vehicle miles per gallon, or other recognized efficiency standards. Most were like Caldwell, where the city manager oversees general purchasing and encourages his superintendents to consider energy/operating costs in all purchases. As an example, Caldwell's baseball park lights are purchased on the basis of energy efficiency, not initial cost.

For further information, contact:

Johnny P. Smith
City Manager
214 W. Buck Street
Caldwell, Texas 77836
Phone: (713) 567-3271

* * * * * * * *

Information Source:

Ivan J. Tether
"Purchasing Strategies for Reducing the Direct Consumption of Energy", p. 1, 20-21.
ECP Report September 1976
(Newsletter of the Energy Conservation Project, Environmental Law Institute)

Conservation Option: Percentage Price Preferences

Percentage price preferences (PPP's) for awarding government purchase contracts have traditionally been used to favor local or in-state bidders. However, they also can provide officials with a mechanism for evaluating "trade-offs" between energy efficiency and initial cost.

PPP's are advantages granted to higher priced items because those products have some desirable quality - in this case, a higher energy efficiency. These advantages are in the form of set percent reductions in acquisition cost that vary depending on the value of a particular quality to a specific government unit.

Because energy efficiency is basically a relative concept, PPP's should be set up as a sliding scale with different percentage reductions for each increase in efficiency. In determining this scale, government officials must keep in mind two questions: (1) how much money (in terms of operating costs) is each increase in efficiency likely to save?; and (2) how are bidders likely to react to the PPP scale?

Although these are difficult questions to answer, PPP's have two important advantages over energy efficient standards. First, this technique does emphasize the trade-off between efficiency and initial cost; energy efficient standards do not consider the cost of individual units of a particular item. Secondly, because PPP's are based on a relative rather than absolute comparison, choices made under this approach are more likely to keep step with technological improvements in efficiency.

Example: Comparison of Results with Hypothetical Bid Evaluations: 3 Techniques

Techniques:

(1) Least cost - traditional method
(2) Least cost with minimum EER of 8 - basic energy efficient standard
(3) Least cost modified by PPP's

Calculations:

(1) Least Cost

Item	Acquisition Cost	Cost
A	$200	7
B	220	7
C	280	9
D	300	11
E	340	12

Outcome: Item A is purchased because the cost is lowest, irrespective of EER.

(2) Least Cost with Minumum EER (8)

Item	EER	Acquisition Cost
A	7	$200
B	7	220
C	9	280
D	11	300
E	12	340

Outcome: Only items with EERs greater than or equal to 8 are considered (C,D,E,). C is chosen because its cost is lowest.

(3) Least Cost Modified by PPP's

Hypothetical PPP Scale

% EER Increase*	% Percentage Price Preference (PPP)
1	1.5
5	3
10	5
15	7
20	10
25	13
30	20
35	23
40	27
45	31
50+	35

*Over lowest bid

Item	EER	% EER Increase	Acquisition Cost	Cost* Increase	PPP(%)	PPP Cost
A	7	----	$200	----	--	$200
B	7	0	220	$ 20	0	220
C	9	28.6	280	80	13	243.6
D	11	57.1	300	100	35	195.0
E	12	71.4	340	140	35	221

*Over lowest bid

Outcome: Item D is purchased because it earned a $105 price preference (35 percent of $300) for its 57.1 percent efficiency increase.

Information Source:

Ivan J. Tether
"Purchasing Strategies for Reducing the Direct Consumption of Energy", pp. 22-23.
ECP Report September 1976
(Newsletter of the Energy Conservation Project, Environmental Law Institute)

Conservation Option: Life-Cycle Costing

Life-Cycle costing (LCC) is a decision-making tool based on the cost of owning and operating an item over its expected lifetime. Traditionally, attention has focused only on the initial cost of an item, particularly for large expenditures such as buildings and vehicle fleets. With the rapid increase in energy prices, however, many local governments have realized that they must use a more complete view of "cost" in their purchase decisions.

Tether identifies seven basic steps in a LCC analysis:

- Identify all acquisition, operating and maintenance costs (including the cost of LCC analysis) for the item
- Determine the useful life of the item
- Estimate its salvage value
- Discount all costs and salvage value to present value
- Complete this calculation:

$$\frac{\text{Discounted Total Cost} - \text{Discounted Salvage Value}}{\text{Years of Useful Life}} = \text{Average Yearly Cost of Ownership}$$

- Compare average yearly costs of ownership for all items under consideration for purchase
- Buy the least expensive item (p. 24)

Example: Simple LCC Problem
Discounting and Salvage Value Excluded (FEA, p.6)

	Products		
	A	B	C
Acquisition Cost	$500	$600	$700
Useful Life (yrs)	2	3	4
Maintenance Cost/yr.	$ 15	$ 10	$ 5
Energy Cost/yr.	$ 25	$ 20	$ 15

Sample Calculation:

$$A = \frac{\$500 + (2 \cdot \$15) + (2 \cdot \$25)}{2} = \$290 \text{ Average Yearly Cost}$$

B= $230

C= $195

Outcome: Item C is purchased because of its lower average yearly cost of ownership.

There are many forms of LCC analysis; even the simplest, as shown above, provides a better basis for purchase decisions than acquisition cost alone. A complete LCC analysis does, however, require more time and expense in administration due to three steps: (1) determination of total cost, (2) price projections, and (3) discounting.

The decision as to what costs should be included in LCC is a difficult one. The U.S. General Services Administration suggests inclusion of special tests/surveys, hardware and accessories, installation, operators, energy, maintenance (parts, workers, transportation), inventory costs, necessary training, inspection, documentation, scrapping cost, and salvage value (p.1-7). Federal requirements for efficiency testing for many common appliances and cars will make the task somewhat easier in the future. In the meantime, it should be re-emphasized that even a simple LCC analysis - using only a few basic costs - is better than relying solely on acquisition cost.

Price projections are necessarily based on educated guesses. Many experts have projected energy prices that are easily obtained for use in LCC. Unfortunately, projection assumptions and methods vary so that results rarely agree, leaving local governments with little defense for whatever price report they select. Tether warns that such price projections may be questioned by suppliers in court. For this reason, he suggests that the safest approach

may be to use present energy prices in the local area (p. 27).

Future costs should be discounted to present value for use in LCC because money on hand is worth more than money received in the future. The discount rate itself is an administrative decision, reflecting how much future return is needed to justify a dollar investment. In the case of conservation, a lower rate will result in increased expenditures for energy efficiency.

LCC can also be used to select the design for a public building from among several alternatives. This process is far more complex than for a routine purchasing decision because of the number of building systems and factors that affect energy efficiency.

* * * * * * * *

City of Dallas
(pop. 844,000)

Dallas has a manual of building design standards to inform architects and engineers of city requirements in the design of new facilities and major modification of existing structures. The LCC concept here is called "value engineering" and is described as follows:

VALUE ENGINEERING

> Traditionally, project budgets and building designs have been based on first costs. First costs, however, are not necessarily an accurate index of the true cost of a building because they do not reflect operating costs. Building designs based upon the first cost concept are not likely to optimize energy requirements because they are not likely to provide high operational efficiencies. Value Engineering is a technique allowing analysis of buildings and systems over the life of the project which permits evaluation of the "trade-off" between a building or system that is inexpensive to build versus one that is inexpensive to operate.
>
> The City of Dallas fully accepts the concept of value engineering, and consistent with development of a VE review capability, intends to employ the technique aggressively to assure procurement of facilities which will provide maximum services at the lowest total cost, including that of operational energy requirements. Sufficient meetings between the owners and the A/E in the preliminary and early design stages shall be scheduled as required to accomplish operating objectives. Building and system design is basically a series

of compromises. Designers must evaluate and explore to the maximum extent possible, the many "trade-offs" available between increased first costs against potential reductions in operating costs and energy requirements.

For further information, refer to:

City of Dallas
Department of Building Services
Design Standards for Maintenance and Energy Conservation, p. 18
September 1976

* * * * * * * *

Excerpts from the detailed Florida Energy Conservation in Buildings Act that discuss legally required LCC follow:

State of Florida
Energy Conservation in Buildings Act

225.251 - Short title
This act shall be cited as the "Florida Energy Conservation in Buildings Act of 1974."

63. Interested officials should contact: Procurement Programs, Experimental Technology Incentives Program, National Bureau of Standards, Washington, D.C. 20234

255.252 - Findings and intent

(1) Operating and maintenance expenditures associated with energy equipment and with energy consumed in state-financed and leased buildings represent a significant cost over the life of a building. Energy conserved by appropriate building design not only reduces the demand for energy but also reduces costs for building operation. For example, commercial buildings are estimated to use from 20 to 80 percent more energy than would be required if energy-conserving designs were used. The size, design, orientation, and operability of windows, the ratio of ventilating air to air heated or cooled, the level of lighting consonant with space-use requirements, the handling of occupancy loads, and the ability to zone off areas not requiring equivalent levels of heating or cooling are but a few of the considerations necessary to conserving energy.

* * *

255.254 - No facility constructed or leased without life-cycle costs

No state agency shall lease, construct, or have constructed, within limits perscribed herein, a facility without having

secured from the division a proper evaluation of life-cycle costs, as computed by a qualified architect or engineer. Furthermore, construction shall proceed only upon disclosing, for the facility chosen, the life-cycle costs as determined in 255.255 and the capitalization of the initial construction costs of the building. The life-cycle costs shall be a primary consideration in the selection of a building design. Such analysis shall be required only for construction of buildings with an area of 5,000 square feet or greater. For leased areas of 20,000 square feet or greater within a given building boundary, a life-cycle analysis shall be performed and a lease shall only be made where there is a showing that the life-cycle costs are minimal compared to available like facilities.

* * *

255.255 - Life-cycle costs

(1) The division shall promulgate rules and procedures, including energy conservation performance guidelines, for conducting a life-cycle cost analysis of alternative architectural and engineering designs and for developing energy performance indices to evaluate the efficiency of energy utilization for competing designs in the construction of state-financed and leased facilities. Such rules and procedures shall take effect 270 days after the enactment of this law.

(2) Such life-cycle costs shall be the sum of:

(a) The reasonable expected fuel costs over the life of the building, as determined by the division, that are required to maintain illumination, power, temperature, humidity, and ventilation and all other energy-consuming equipment in a facility, and

(b) The reasonable costs of probable maintenance, including labor and materials, and operation of the building.

(3) To determine the life-cycle costs as defined in subsection (2)(b), the department shall promulgate rules that shall include, but not be limited to:

(a) The orientation and integration of the facility with respect to its physical site.

(b) The amount and type of glass employed in the facility and the directions of exposure.

(c) The effect of insulation incorporated into the facility design and the effect on solar utilization of the properties of external surfaces.

(d) The variable occupancy and operating conditions of the facility and subportions of the facility.

(e) An energy consumption analysis of the major equipment of the facility's heating, ventilating, and cooling system, lighting system, hot water system, and all other major energy-consuming equipment and systems as appropriate This analysis shall include:

1. The comparison of alternative systems.

2. A projection of the annual energy consumption of major energy-consuming equipment and systems for a range of operations of the facility over the life of the facility.

3. The evaluation of the energy consumption of component equipment in each system, considering the operation of such components at other than full or rated outputs.

(4) Such rules shall be based on the best currently available methods of analysis, including such as those of the National Bureau of Standards, the Department of Housing and Urban Development, and other federal agencies and professional societies and materials developed by the department. Provisions shall be made for an annual updating of rules and standards as required.

* * *

To assist in implementing this building design philosophy, the Bureau of Construction, Florida Department of General Services, developed for their own use an energy and economic analysis computer program called FLEET (Florida Lifecycle Energy Evaluation Technique). Available to other interested local governments is an accompanying FLEET user manual, an energy conservation manual containing energy budgets and design guidelines, and a third manual for calculating life cycle analysis by hand (see information sources).

Tether summarizes his detailed discussion of LCC with the following list:

Advantages

1. LCC is cost-effective
2. LCC is a wise procurement technique even in the absence of energy conservation considerations
3. LCC can be applied in an abbreviated form and still provide a better comparison of alternative acquisitions than is provided by low first cost
4. LCC provides a more effective trade-off between acquisition price and energy (operating) costs than either energy efficiency standards or percentage price preferences

Disadvantages

1. LCC requires more complex analysis and may be more expensive to apply than either energy efficiency standards or percentage price preferences
2. Legislation may be required to implement LCC
3. LCC is likely to require payment of higher acquisition costs (p. 30)

Information Sources:

Ivan J. Tether
"Purchasing Strategies for Reducing the Direct Consumption of Energy", pp. 23-30
ECP Report September 1976
(Newsletter of the Energy Conservation Project, Environmental Law Institute)

Council for State Governments
State and Local Government Purchasing, p. 11.8
Lexington, Kentucky: Council of State Governments, 1975.

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, p. 6
Washington, D.C.: U.S. Government Printing Office, 1976.

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, p. 26
n.p.: Public Technology, Inc., 1975

U.S. General Services Administration
Life Cycle Cost Workbook, p. I-7
Washington, D.C.: U.S. Government Printing Office, n.d.

State of Florida
Department of General Services
Bureau of Construction
.Florida Lifecycle Energy Evaluation Techniques (FLEET)
.Florida Energy Conservation Manual
.Florida Life Cycle Analysis Manual

Conservation Option: Value Incentive Clause

A "value incentive clause" is a provision in a fixed price supply contract that rewards the supplier for energy-saving innovations. If items delivered after the contract is awarded are shown to be more energy efficient, the supplier receives a fixed percentage of the savings achieved.

This strategy to improve energy efficiency was implemented in 1975 by the U.S. General Services Administration. The clause is included in fixed price GSA supply contracts over $100,000 governed by design specifications. It permits the supplier to share up to 50 percent of the savings.

The only significant legal impediment to the value incentive clause are state/local laws that restrict the length of government contracts. Because innovation and submission of tests to prove increased efficiency take time, the clause works most effectively in long-term supply contracts. Otherwise, this option should prove cost-effective to local governments since payments to the supplier come entirely from savings made possible by the innovation. The only costs to the local government are in administration and should generally be very small.

Example:

Value Incentive Clause royalty = 50% of savings

10% savings on energy for electric letter openers = $32,961.08

Royalty to supplier = 50% x $32,961.08
= $16,480.54

Savings to city in budgeted energy costs = $16,480.54

Information Sources:

Ivan J. Tether
"Government Procurement and Energy Conservation", p. IV-119
Energy Conservation Training Institute
(Sponsored by The Conservation Foundation, Washington, D.C., under contract to the Federal Energy Administration)

Ivan J. Tether
"Purchasing Strategies for Reducing the Direct Consumption of Energy", p. 31
ECP Report September 1976
(Newsletter of the Energy Conservation Project, Environmental Law Institute)

Conservation Option: Design vs. Performance Specifications

Design specifications are detailed descriptions of how a product should be constructed. Historically, they have been used to specify the form of public construction projects such as highways, buildings, and bridges. Be-

cause design specifications prepared by a city cannot be expected to always match products designed by suppliers, they may unnecessarily restrict competition or stifle innovation by the private sector.

Performance specifications are currently gaining popularity as being more supportive of innovation, cost reduction, and increased efficiency. These specifications set out performance requirements without specifying design. Tests or criteria are then developed to measure compliance with the specification.

While most specifications are a combination of approaches, emphasis on performance will generally encourage energy efficiency to a greater extent. The primary exception to this statement lies in the use of value incentive clauses. To lessen the possibility of fraud, contracts using a value incentive clause should be governed by design standards.

Information Sources:

Council of State Governments
State and Local Government Purchasing, pp. 11.6 - 11.9
Lexington, Kentucky: Council of State Governments, 1975

Ivan J. Tether
"Government Procurement and Energy Conservation", p. IV-121
Energy Conservation Training Institute
(Sponsored by The Conservation Foundation, Washington, D.C., under contract to the Federal Energy Administration)

Ivan J. Tether
"Purchasing Strategies for Reducing the Direct Consumption of Energy", p. 30
ECP Report September 1976
(Newsletter of the Energy Conservation Project, Environmental Law Institute)

Conservation Option: Special Purpose Specification

A common purchasing technique for one-of-a-kind items is the designation of a special purpose. A normal specification is accompanied by a questionnaire asking suppliers what modifications they would be willing and able to make for a specific purpose - in this case, the improvement of energy efficiency. The purchasing official then evaluates the alternatives offered by respondents. This technique encourages innovation for energy efficiency

without requiring expensive retooling or special production for small or experimental orders.

Information Sources:

Council of State Governments
State and Local Government Purchasing, p. 11.6
Lexington, Kentucky: Council of State Governments, 1975

Ivan J. Tether
"Purchasing Strategies for Reducing the Direct Consumption of Energy", p. 32
ECP Report September 1976
(Newsletter of the Energy Conservation Project, Environmental Law Institute)

* * * * * * * *

Government Purchasing in the State of Texas Energy Conservation Plan

Title III of the Energy Policy and Conservation Act of 1975 (EPCA), P.L. 94-163, provides federal funding support for voluntary state participation in the development and implementation of state energy conservation plans. By participating in the program, a state commits itself to develop a comprehensive plan that would result in a 5 percent energy savings by 1980. To be eligible for implementation funding, the state plan must include five programs outlined in the enabling legislation; one of these programs involves mandatory standards and policies relating to energy efficiency to govern the procurement practices of the state and its political subdivisions.

In the final draft, the Texas plan proposes a purchasing program based on the development and widespread distribution of information concerning the actual energy utilization of many commonly-used items. Under leadership of the State Board of Control, an advisory committee with representatives from the Texas Municipal League (1), the Texas Association of Counties (1), the Texas Education Agency (1), and purchasing agents from cities (3) and school districts (3) would develop a list of the most commonly purchased energy consuming items. The Board of Control would have responsibility for performing energy analyses of those items not already available from the Federal Supply Service or the National Bureau of Standards.

A major part of the program involves dissemination of this product information to Texas local governments. During the first quarter of 1978, the state plan calls for the publication and distribution to all state, municipal, county, and school district purchasing offices/agents of a newsletter describing the purchasing program, life cycle costing and product energy analysis techniques. Milestones in the second quarter of 1978 include review of legal barriers to centralized or cooperative purchasing; drafting of enabling legislation (if needed) to increase the economy and efficiency of purchasing; and the publication of a second newsletter with a list of purchased items and their life cycle cost analyses. Subsequent newsletters through 1980 would provide energy data on new products or items requested by state and local agencies.

For further information, refer to:

Governor's Office of Energy Resources
State of Texas Energy Conservation Plan, Vol. II, pp. 35-41
June 1977 (Draft)

* * * * * * * *

Municipal Planning

Conservation Option: Comprehensive Plans with Energy Conservation as a Goal

A comprehensive plan is a long-range policy guide based on careful study of community goals, resources, and characteristics. Although there is no Texas law requiring municipalities to engage in comprehensive planning, such an undertaking can be of tremendous value in making the best of future limited energy as well as providing other benefits in terms of money, natural resources, time, and the environment.

While some controversy exists as to the proper form for energy efficient communities, Harwood summarizes research in this area as generally agreeing on the need for the following:

- Planned development rather than uncontrolled, haphazard growth
- Encouragement of higher density developments
- Restraint of urban sprawl
- Mixed-use and multiple-use developments where zoning previously prevented integration of uses
- Housing development close to jobs
- Rebuilding of cities to make urban life more attractive (p. IV-169)

It is immediately apparent that these actions are quite long-range in nature. However, without careful planning now and growth management, cities cannot hope to become significantly more energy efficient in the future.

One way to inject energy conservation/efficiency into the municipal planning process is to adopt general policies on energy as a guide to developing the local comprehensive plan. State energy conservation guidelines could serve as policy models or local governments may develop their own statements.

Example: Energy Goals and Policies Adopted by the Lincoln, Nebraska City Council and Lancaster County, Nebraska Board of Commissioners, January 1976

PREFACE: All energy goals and policies should be weighed carefully against the goals and strategies developed to prevent a negative employment or economic effect as well as any adverse effects upon the community as a whole.

ENERGY

IMPLEMENT THE CONCEPT OF STEWARDSHIP AND CONSERVATION REGARDING THE UTILIZATION OF EXHAUSTIBLE ENERGY RESOURCES, INCLUDING THE IMPROVED EFFICIENCY OF THE DEVELOPMENT OF LAND AND SUPPORTING SYSTEMS, AND PREPARE FOR THE CONVERSION TO NEW ENERGY SOURCES AS TECHNOLOGY AND FINANCIAL FEASIBILITY PERMIT.

ENERGY SUB-GOAL 1: LAND USE

Regulate the use of land and encourage the use of urban design so as to minimize the demand for energy consumption and maximize the effectiveness of energy consumed.

POLICIES

1. Regulate the use of land so as to provide higher density residential facilities in proximity to the Lincoln Center and other major activity centers.

2. Encourage the development of fewer and more intense multi-purpose centers and their concentration as opposed to the scattering of such activities in order to provide opportunity to eliminate or substantially reduce auto travel.

3. Encourage people to live in proximity to activity centers and particularly their place of employment.

4. Emphasize the revitalization of the Lincoln Center and the rehabilitation or redevelopment of established neighborhoods near the Lincoln Center.

5. Encourage radial or concentric growth about the Lincoln Center with new development to north, west, and south. When the objectives establishing growth areas to the north, west, and south have been substantially developed, growth to the east into Stevens Creek watershed area may be pursued.

6. Encourage land use arrangements and densities that facilitate energy-efficient public transit systems.

7. Encourage existing and future industries to conserve energy and improve energy efficiency.

8. Encourage site planning and designs which reduce demand for artifical heating, cooling, ventilation, and lighting.

9. Encourage the investigation of energy conservation and improved energy efficiency possibilities of centralized heating and cooling facilities serving building complexes.

ENERGY SUB-GOAL 2: TRANSPORTATION

1. Provide the facilities and programs for increased utilization of public transit, carpooling, and bicycle and pedestrian systems.

2. Reduce the need for and utilization of the private automobile.

3. Continue to improve the effectiveness of existing and future roadways so as to minimize unnecessary energy consumption by improving circulation through engineering procedures and roadway improvements.

* * *

ENERGY SUB-GOAL 3: COMMUNITY FACILITIES

Exhibit governmental leadership and innovation related to the conservation and efficient utilization of energy for community facilities and services.

POLICIES

1. The location, design, and operation of community facilities such as schools, churches, libraries, recreational facilities, university facilities, and other public buildings should encourage energy conservation and efficient energy utilization by such means as multi-purpose or joint uses.

* * *

3. All public lighting systems should be designed and operated to efficiently utilize energy without sacrificing public safety.

* * *

ENERGY SUB-GOAL 4: BUILDING DESIGN

Encourage the design and construction of buildings and building complexes so as to effectively utilize all energy sources.

POLICIES

1. Building design and orientation should strive to effectively utilize natural lighting and reduce the effects of exposure to extreme weather conditions, thereby reducing the need for mechanical heating, cooling, and ventilation.

* * *

4. Landscape materials should be utilized effectively to reduce the adverse effects of weather conditions.

* * *

6. Buildings should be designed and built to utilize waste heat to reduce the demand on public utilities.

* * * * * * * *

City of Austin
(pop. 308,087)

Austin's Planning Commission chose goals of environmental preservation and growth management as guidelines for Chapter Two,"Government and Utility Services," of its comprehensive plan. The importance of energy conservation in this area is shown by supportive objectives and policies as follows:

GOAL 410.0: PROVIDE UTILITY SERVICES IN THE MOST EFFICIENT AND EQUITABLE MANNER CONSISTENT WITH SOUND ENVIRONMENTAL AND GROWTH MANAGEMENT POLICIES.

Three major areas of concern relating to utilities include direct environmental effects of utility facility construction and operation, energy and resource conservation, growth management and reduced sprawl.

Objective 412.0: Minimize environmental damage in the construction and operation of utility facilities.

Objective 412.1: Actively pursue programs to promote energy and resource conservation.

Policy 412.1: Evaluate electric rate structure changes as a means of promoting energy conservation.

Electric rate making includes allocation of production costs to customers and encouragement of stable electric loads to maintain low average per kilowatt hour cost. (See comment under Policy 312.5). Under current rates, the per unit charge for electricity consumed decreases as the amount of electricity consumer increases, in addition to economy of scale and higher charges for peak use. Consideration should be given to lowering per kilowatt hour charges for low volume users relative to high volume users within a particular user group (e.g. residential, commercial)

to provide greater incentive to conserve energy.

Policy 412.2: Discourage the use of outdoor lighted displays and signs which consume an excessive amount of electricity.

Some lessening of electricity demand, and thereby electric generating fuel, could be realized through minimizing usage of lighted outdoor signs. Restrict total electric demand of new signs.

Policy 412.3: Evaluate building codes and technology on a continual basis to improve heating and cooling efficiency.

Policy 412.4: Undertake public education programs to encourage more efficient use of heating, lighting and air-conditioning systems and household appliances through public education.

Policy 412.5: Encourage a more even load of electric use between peak and off-peak times.

The previous policies relating to electric consumption are aimed at reducing energy and fuel consumption through a reduction in total kilowatt hour electric usage. A major portion of the cost of providing electricity is the cost of the generating facilities. These must be constructed to meet peak demand. A reduction in off-peak usage without a reduction in peak usage would thus require larger per kilowatt hour expenditures for the provision of electricity. In order to reduce the amount of capital expenditure required for the operation of the electric utility it is necessary to reduce the increase in the peak demand of electricity.

Policy 412.6: Continue to investigate alternative fuel sources for electric generation considering aspects of cost, resource conservation and environmental hazards.

Policy 412.7: Continue to investigate the feasibility of alternatives for the disposal of solid waste.

Currently Austin's solid waste is disposed of in sanitary landfills. It is recommended that portions of the solid waste be recovered either through the recycling of metals and minerals, the burning of waste materials for use as an electric energy source or possibly the use of solid waste for soil conditioning.

Objective 413.0: Promote a compact, contiguous and planned urban form using utility service to guide growth.

The patterns of growth can significantly affect the quality of the natural landscape and the cost of providing the many municipal services needed for the maintenance of the community. The sequence of development and its resulting pattern have direct bearing on the cost of providing utility services. The most efficient pattern of development for the provision of municipal services is one that is compact, with minimum distances required to provide services from central locations. This applies to the distribution of water, collection of wastewater, electric transmission, garbage collection, police and fire service. Requirements for transportation rights-of-way are minimized in a compact urban configuration through reducing personal travel distances. The compact and contiguous form would also aid in minimizing the encroachment of new development into environmentally sensitive areas. One method to direct the location of development is through the planned extension of municipal utilities and the concurrent encouragement of development to fill in areas served by the new extensions of utilities before additional extensions are made.

* * *

For further information, contact:

Dick Lillie
Director of Planning
P.O. Box 1088
Austin, Texas 78767
Phone: (512) 477-6511

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Information Sources:

Corbin Crews Harwood
"Planning for Energy Conservation," pp. 6-7, 13.
ECP Report March 1976
(Newsletter of the Energy Conservation Project,
Environmental Law Institute)

Real Estate Research Corporation
The Costs of Sprawl
Washington, D.C.: U.S. Government Printing Office, 1974.

Corbin Crews Harwood
"Land Use and Energy Conservation", pp. IV-169-184.
Energy Conservation Training Institute
(Sponsored by The Conservation Foundation,
Washington, D.C., under contract to the
Federal Energy Administration)

Conservation Option: Joint Planning for Energy Conservation

Land use decisions in one jurisdiction can have tremendous "external" impacts on land use patterns in adjoining municipalities. For example, zoning for concentration of heavy industry at one city boundary will mean that adjacent land in the neighboring city cannot realistically be expected to support upper-income single-family residential development. This problem is particularly significant where several communities experience rapid population growth from nearby energy-related projects, e.g., nuclear plants, new strip or underground mines, etc.

Joint planning in situations of extended impact can provide some measure of control in terms of energy usage for the cities involved. In Texas, joint municipal planning is authorized under Article 1011-1, V.T.C.S., as follows:

> "Art. 1011-1. Joint Municipal Planning in Certain Areas
>
> "Grant of Power to Expend Public Funds.
>
> "Section 1. Each city (including home rule charter cities, town, or village incorporated under the laws of this State, or by special act or charter, is hereby authorized, by ordinance duly passed, to expend public funds from the municipal treasury for compiling statistics, conducting studies and formulating plans

relative to the future growth and development of such municipality or municipalities.

"Municipalities Subject to Act.

"Sec. 2. Municipalities located or situated in whole or in part within an area wherein the sphere of zoning influence of each municipality is adjacent or contiguous to the other may contribute, and/or expend, public funds from the municipal treasury, to a joint planning commission for the joint planning of the growth and development to two (2) or more of such municipalities that are located or situated in whole or in part within the sphere of influence of such planning commission.

"Joint Planning Commission.

"Sec. 3. Municipalities affected by this Act shall, if they adopt the provisions hereof, by the governing bodies of each of such municipalities, appoint an equal number of representatives, from each of the municipalities affected hereby, to a joint planning commission, and it shall be the duty of such joint planning commission to meet and determine the sphere of influence of such planning commission which they shall describe by metes and bounds in writing and cause the same to be placed upon a map and the same shall be recorded for record with the county clerk of the county within which such municipalities are located or situated.

"Powers and Duties of Commission.

"Sec. 4. The duties, powers and authorities of such joint planning commission, so appointed by the governing body of such municipalities, shall be as follows, as authorized by ordinances duly passed within each of such municipalities, to wit:

"(a) To employ engineers, clerks, secretaries, field personnel, and administrative personnel as are necessary to formulate, prepare, and design an organized master plan for the area as designated.

"(b) To prepare, formulate, and design an organized master plan for the area which such members represent, including, but not limited to, highway design, street layout, park layout, schooling areas, residential areas, business area, commercial area, industrial area, such plan must be approved by each of the municipalities within the area.

"(c) To make aerial photographs, land surveys, and topography studies to facilitate such planning.

"(d) To keep and maintain a complete record of all activities, meetings, expenditures, and plans.

"(e) To submit regular reports of income, expenditures, accounts, and progress reports to each municipality represented.

"(f) All records, minutes, books, accounts and meetings shall be open to the public for attendance and/or examination.

"(g) To prepare and submit to each munitipality represented an annual audit of all accounts, expenditures, funds and moneys coming into the hands of said joint planning commission.

"(h) To make all reports, accounts, and records as may be required by each of the municipalities represented, by ordinance or resolution duly passed.

Information Sources:

U.S. Department of Housing and Urban Development
Rapid Growth from Energy Projects, pp. 19-23.
Washington, D.C.: U.S. Government Printing Office, 1976

Texas Office of the Governor
Division of Planning Coordination
The Legal Basis for Planning in Texas: A Handbook, pp. III-9, 10.
Austin, Texas 1973.

Special Information Source: ASPO's Report No. 315

The topic of municipal planning for energy conservation is so broad and far-reaching that several volumes could be devoted to its discussion alone. Rather than review planning conservation options and experiences in such detail here, the authors recommend that interested local officials consult the American Society of Planning Officials (ASPO) Planning Advisory Service Report No. 315. Entitled Energy-Efficient Planning: An Annotated Bibliography, this report covers 114 citations in the following general areas:

- Background, Policy, and Implications
- Policy Statements
- Zoning and Subdivision Controls
- Transportation/Land-Use Planning
- Regional Planning
- Designs for Building and Sites

If not available in a local public or university library or at the area regional planning council, this report may be purchased through the following address:

American Society of Planning Officials
1313 East Sixtieth Street
Chicago, Illinois 60637

Cost: $5 to Planning Advisory Service subscribers, $6 to others.

Building Codes and Ordinances

Conservation Option: Adopt Energy Conservation Provisions for Building Codes

Texas cities are able to adopt and administer building codes to protect the health, safety, and welfare of the public through the delegation of the state's police power to local governments for this purpose. Generally, cities adopt a model building code prepared by one of several nationally recognized code organizations, which tend to serve specific geographical areas of the country. The city may or may not amend the model code before adoption.

Recently, these code organizations have taken steps to incorporate energy conservation standards into their model codes. In 1975, the Council of American Building Officials' (CABO) Board of the Coordination of Model Codes developed a model energy conservation code based on the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 90-75. CABO then recommended that this conservation code be included in the code change procedures of the three member model code organizations for adoption in whole or in part as an amendment to the model codes. Action was taken on this recommendation as follows:

- Building Officials and Code Administrators International, Inc., (BOCA) adopted energy conservation criteria for new buildings paralleling the CABO recommendations in the body of its code. The supplement to the BOCA code was published in October, 1976.
- International Conference of Building Officials (ICBO) approved the CABO recommended code as an appendix to its Uniform Code in October, 1976.
- Southern Building Code Conference (SBCC) approved the recommended code provisions as Appendix J to the Standard Building Code in November, 1976.

The Energy Research and Development Administration (ERDA), the three model code groups, the National Conference of States on Building Codes and Standards, Inc., and the National Academy of Code Administration (NACA) are also working together to develop a model building code emphasizing energy conservation and a comprehensive energy conservation training curriculum to support it.

The point of emphasis here is that Texas cities must take an active part in adopting any energy conservation amendments to whatever model building

code they use. All the model code organizations have an internal code change and adoption process to insure the continuing viability of their document. However, that change becomes local law only if enacted by the city's governing body. Generally, it is the duty of the local building official to promote the adoption of the latest regulations within the bounds of the city charter.

A city may also wish to develop its own energy conservation criteria for the local building code based on local studies or initiative in areas not addressed by the model code organizations.

Example: Davis, California, Energy Ordinances

The State of California adopted an energy conservation addition to the state building code in 1975. Davis - a city of 38,000 - had already begun to address the problem of conservation by conducting energy studies specific to that city. In January 1976, Davis passed its own building code by an ordinance establishing performance standards exceeding the state code requirements. The city also plans to implement further ordinances dealing with conservation standards in such areas as site design for developments, street widths, and solar-heated homes.

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City of Austin
(pop. 308,087)

Austin has made frequent use of ordinances to address specific energy conservation opportunities. The Austin Energy Conservation Commission has prepared ordinances (subsequently passed by the City Council) on such subjects as increased insulation in buildings, duct work, and steam condensate pipe; minimum requirements for energy efficiency ratios (EER) in air conditioning systems; and a requirement for individual metering of apartments presented in totality below as an example.

ORDINANCE NO. 761104-C

AN ORDINANCE AMENDING THE AUSTIN CITY CODE OF 1967 BY THE ADDITION OF SECTION 60 TO CHAPTER 37; DEFINING WORDS AND TERMS; PROVIDING FOR SEPARATE ELECTRIC SERVICE METERING; PROVIDING A PENALTY CLAUSE; PROVIDING A SEVERABILITY CLAUSE; SUSPENDING THE RULE REQUIRING THE READING OF ORDINANCES ON THREE SEPARATE DAYS; AND DECLARING AN EMERGENCY.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF AUSTIN:

Part 1. That Chapter 37 of the Austin City Code of 1967 is hereby amended by adding thereto Section 37-60 which shall read as follows:

Sec. 37-60. Individual electric metering for dwelling units.

(a) Definitions:

Apartment. A dwelling unit part of, or within, an apartment house or apartment hotel.

Apartment hotel. A building containing apartments rented for nontransient use and having a desk or lobby and providing some services customary and appropriate to a hotel, such as room and housekeeping service, but not having any public meeting rooms.

Apartment house. A building containing three or more apartments rented for nontransient use.

Dwelling unit. A room or suite or set of rooms occupied, or suitable for occupancy, as a family residence, and having kitchen, bath and sanitary facilities, together with appropriate appurtenances to such occupancy.

Dormitory. A building, other than a hotel or motel, containing rooming units without individual kitchen facilities to be used for residential purposes. Rental of each unit must be on a weekly basis or longer.

Duplex. A building containing two dwelling units.

Hotel. A building or part of a building in which there are (1) guest rooms for living or sleeping accommodations which are primarily used for transient occupancy and which are customarily rented on a daily basis; (2) one or more common entrances to serve all guest rooms; (3) desk or lobby service and telephone, maid, linen, room and similar services. A hotel may contain a restaurant; provided, that the entrances to such restaurant shall be from within the building only and not from any street, alley or public property.

Motel. A building or group of buildings developed as an integral unit in which there are: (1) guest rooms for living or sleeping accomodations which are primarily for transient occupancy and which may be rented on a daily basis; and (2) desk or lobby service and telephone, maid, linen, room and similar services. Guest rooms may have individual entrances.

Permitted. The actual receipt of building permit from the building inspection department of the City of Austin.

Person. Means one or more individuals, an association, or corporation.

(b) Applicability:

(1) The provisions of subsection (c) of this section shall apply only to structures that shall be permitted after January 1, 1977, in the area served by the electric department of the City of Austin.

(2) The penal provisions of this section shall apply only to those actions or activities which are herein proscribed that occur within the incorporated limits of the City of Austin, Texas.

(c) Individual metering; Exceptions:

(1) The use of electric service supplied by the city shall be metered separately for each dwelling unit.

(2) Service hereunder shall be in accordance with Rules and Regulations prescribed by the City of Austin from time to time.

(3) In such construction or facility where individual metering is required for dwelling units, there shall be a separate meter or meters for the common areas of each such facility.

(4) Exceptions:

(i) Nothing contained herein shall prevent the use of a common meter for heating, cooling, and water heating units which serve four or more dwelling units in an apartment house or apartment hotel.

(ii) Nothing contained herein shall apply to any apartment house or apartment hotel federally funded and operated by the Austin Housing Authority.

(d) Enforcement:

(1) The building official, or his designate, shall have the express power to deny a certificate of occupancy for any building that is permitted after January 1, 1977, that is not in compliance with the provisions of this section.

(2) Any person who willfully or knowingly installs a metering system contrary to that described in subsection (c) above shall be guilty of a misdemeanor and fined not less than twenty-five dollars ($25.00) or more than two hundred dollars ($200.00) and each such day that said illegal metering system shall be used shall constitute a separate violation.

(3) In addition to other remedies herein provided, the building official or his designate of the City of Austin shall have the right,

after notice and hearing, to suspend or terminate electric service to any person not in compliance with any provision of this section.

(e) Severability clause:

If for any reason any section, paragraph, subsection, clause, phrase, word or provision of this ordinance shall be held to be invalid, or unconstitutional by final judgment of a court of competent jurisdiction, it shall not affect any other section, paragraph, clause, phrase, word or provision of this ordinance.

Part 2. The need to reduce energy consumption in the City of Austin constitutes an emergency for the immediate preservation of order, health, safety and general welfare of the public, which emergency requires the suspension of the rule providing for the reading of an ordinance on three separate days, and requires that this Ordinance become effective immediately upon its passage, therefore the rule requiring the reading on three separate days is hereby suspended and this Ordinance shall become effective immediately upon its passage as provided by the Charter of the City of Austin.

PASSED AND APPROVED

November 4, 1974

For further information, contact:

Pieter Sybesma
Research and Budget Division
P.O. Box 1088
Austin, Texas 78767
Phone: (512) 477-6511, ext. 2240

* * * * * * * *

Information Sources:

Institute of Urban Studies,
University of Texas at Arlington
Energy Conservation in Buildings, pp. 97-102
Arlington, Texas: University of Texas at Arlington, 1976.

Gloria Shepherd McGregor, AIP
"Davis, California Implements Energy Building Codes", pp. 22-31
Practicing Planner February 1976

City of Austin
Energy Conservation Commission First Annual Report, January 31, 1975
Report of City of Austin Energy Conservation Commission,
February 1, 1975 - January 31, 1977

National Conference of States on Building Codes and Standards, Inc.
Model Code for Energy Conservation in New Building Construction (Draft) 1977
McLean, Virginia

Special Information Source: FEA's Impact Assessment of ASHRAE 90-75

In 1974, the American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) undertook the development of a thermal efficiency standard capable of providing national guidance for energy usage in all types of new construction. The result is commonly called "ASHRAE 90-75" and has been incorporated in some form into each of the major model building codes.

In 1975, the Federal Energy Administration contracted with Arthur D. Little, Inc., to examine ASHRAE 90-75 for its impact on the following areas: building characteristics, building energy consumption, building economics, national energy demand, selected building-related industries, key industry participants, and building habitability. The final report contains many technical analyses for each area; the more important conclusions are summarized below to give local officials an idea of the standard's potential for energy conservation.

- Under strict interpretation of the standard, building energy consumption can be significantly reduced in all building types and geographic locations examined. Unweighted average annual reductions across the four locations studied were:

Single-family residence	-11.3%
Low-rise apartment building	-42.7%
Office building	-59.7%
Retail store	-40.1%
School building	-48.1%

- While the standard appears more effective in colder climates because of the proportionally larger demand for space heating, it results in increased air conditioning efficiency as well.
- ASHRAE 90-75 would result in the following changes in building's physical characteristics: reduction of glass area (up to 30%); increase in net wall area (less than 8%); additional insulation, particularly in non-residential construction; reduction in lighting;

and reduction in HVA/C system capacities.

- ASHRAE 90-75 modified buildings should cost no more to build than conventional designs. If total initial cost did increase, the savings in operating costs would recover the additional costs in a few months.
- ASHRAE 90-75 could reduce annual national energy consumption in new construction by 27% if instituted and enforced in all states. Even if adopted only by those 29 states currently having mandatory or voluntary statutes, or with bills pending, consumption could be reduced significantly since 75% of all new construction lies within their borders.

The complete report and/or executive summary are available through the U.S. Government Printing Office:

Federal Energy Administration
An Impact Assessment of ASHRAE Standard 90-75
FEA/D - 76/078 and 079

* * * * * * * *

Thermal Standards
in the
State of Texas Energy Conservation Plan

Another of the mandatory state programs under Title III of the Energy Policy and Conservation Act of 1975, (EPCA), P.L. 94-163, concerns the development and adoption of statewide thermal efficiency standards for new and renovated buildings. Such standards are meant to impose minimum energy conservation requirements on affected buildings.

Texas does not have a statewide building standard. As noted before, Texas cities have been delegated the authority to regulate local construction with the result that about 90 percent of the over 1,000 incorporated cities have their own building code. Legally, however, Texas cities are allowed to include thermal efficiency standards in their codes. Several efforts are underway to develop model standards; ASHRAE 90-75 and the National Conference of States on Building Codes and Standards have already been mentioned. In addition, the Texas State Building Committion is required to develop a model standard for consideration by local authorities under Article 678i, Texas Civil Statutes.

If approved and funded, the state conservation plan calls for three

tasks to implement this program measure. First, existing thermal efficiency standards would be collected, evaluated, and the results presented to local officials in regional meetings. Six cities would be selected as test sites for model standards. Second, the best single code or combination of code sections would be drafted into a state standard for presentation to the 66th Legislature. Such a standard would, however, not necessarily be enforced by the state government. Finally, another series of regional meetings would be held to inform local officials of the new standard and train code enforcement personnel.

For further information, refer to:

Governor's Office of Energy Resources
State of Texas Energy Conservation Plan,
Vol. II, pp. 7-15
June 1977 (Draft)

* * * * * * * *

Conservation Option: Train Building Inspectors in Energy Conservation Standards

Without proper enforcement of an updated code containing conservation standards, a city cannot hope to make any impact on energy usage in buildings. Without training in those areas of energy conservation code enforcement that are not common practice, local building inspectors cannot be efficient in their work.

The model code organizations have anticipated this need for extra training and foresee additional job performance requirements for code enforcement personnel as follows:

- Plans Examiners:

  1. Must be able to discuss energy code provisions, including mechanical systems, with the designer
  2. Must review design computations for conformance to energy code
  3. Must review the following for conformance to both energy requirements and non-energy requirements (i.e., flame spread, smoke generation):
     - Wall, ceiling and floor details shown on plans
     - Piping and duct insulation
     - Specifications

4. Must review the following systems for conformance to the energy provisions:
   - Mechanical equipment including heating and air conditioning systems, ventilating units, and water heater
   - Electrical equipment including lighting and distribution systems

- Inspectors:

1. Must insure that insulation requirements for foundations, floors, walls, and ceilings conform with approved plans
2. Must insure that insulation materials conform to the approved specifications for "R" values, flame spread, smoke generation, and windows and doors (glazing, weatherstripping)
3. Must inspect labels on mechanical equipment to insure that the size and type conform with the approved plans and specifications
4. Must inspect lighting fixtures and electrical distribution systems for conformance with the approved plans and specifications (IUS, p. 100)

The Council of American Building Officials, the National Academy of Code Administrators, and the National Conference of States on Building Code Standards are developing educational courses for the following levels of personnel: plans examiner for a large city, plans examiner for rural and small cities, inspectors and contractors, and governmental officials. Programs will include material on the importance of energy conservation, fundamentals of heat transfer, the energy code and code applications - all directed toward the specific job needs of each personnel level.

Information Sources:

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, pp. 50-51
Washington, D.C.: Public Technology, Inc., 1975

Institute of Urban Studies,
University of Texas at Arlington
Energy Conservation in Buildings, pp. 100-101
Arlington, Texas: University of Texas at Arlington, 1976

National Conference of States on Building Codes
and Standards, Inc.
"Training Program" (Mimeographed)

Conservation Option: Combined Municipal Inspections

Cities have many health and safety codes that require trained inspectors for enforcement. Usually, these inspectors specialize in one area so that several individuals must examine each project to certify its compliance with various codes.

One conservation option would be the training of each city inspector in several code inspection/enforcement procedures. Besides allowing individual employees to take a broader view of each project - which may prove more interesting, thereby increasing inspector morale and productivity - this option can greatly reduce vehicle mileage.

* * * * * * * *

City of Dallas
(pop. 844,000)

Three years ago, the Dallas Department of Housing and Urban Rehabilitation implemented an interdepartmental code enforcement program that has since evolved into a rather sophisticated computer system designed to support this city-wide activity. The code enforcement program deals with environmental-type violations involving the following departments: Department of Housing and Rehabilitation, Action Center, Department of Streets and Sanitation, Health Department and Fire Department. It was introduced into the revenue-sharing budget for fiscal year 1973-74.

The directors of these departments formed the Integrated Inspection Committee which analyzed existing ordinances to determine overlapping areas of authority in regard to environmental-type violations. A new Integrated Inspection Form was developed with the appropriate city ordinances printed on the reverse of the form for easy reference (Figure 2.2). The committee also designed a training curriculum for inspectors that included a "field manual" and handbook. Thirty-one classes were held for the first training program; additional classes are currently being held for new personnel.

Responding to the complex manual record keeping and reporting require-

Figure 2.2

CITY OF DALLAS

NOTICE OF VIOLATION

CERTIFICATE **№ 171661**

I. Legal Location of Violation: Address _____
Street Number Street Direction Street Name

Improved _____ Unimproved _____ Lot Number _____ Block Number _____

Owner/Agent/Person-in-Control: _____ Phone No. _____

Address: _____ City _____ State _____ Date _____

II. IN ORDER TO CORRECT EXISTING VIOLATION(S): _____

1. Remove all combustible waste, insect and rodent harborage, improperly stored garbage, trash/debris within _____ days.
2. Immediately remove the latching device on abandoned or dangerously exposed refrigerators, freezers, or iceboxes.
3. Stack usable lumber at least 5' from any building or property line, not more than 6' in height, 18" above the ground and keep free from trash and grass within _____ days.
4. Secure all openings to building to prevent the entry of unauthorized person within _____ days.
5. Provide approved containers (closed metal container or safety can) not to exceed 10 gallons for storage of flammable or combustible liquids within _____ days.
6. Obtain a permit as required by the Dallas City Building Code before work is resumed.
7. Eliminate visibility obstruction within _____ days. NOTE: _____
8. Cut and remove weeds in excess of 12" height: _____ in alley _____ parkway _____ Private property within _____ days.
9. Eliminate all hazards from premises within _____ days.
   a. Open wells, septic tanks or cellars
   b. Uncovered excavations
   c. Dead or decaying trees
   d. Ingress and egress blockage
   e. Other
10. Eliminate conditions which cause the existence of surface water/or sewage on premises within _____ days.
11. Eliminate the standing water, in which mosquitoes breed or are likely to breed, within _____ days.
12. Eliminate unsanitary conditions, caused by animals or pets, within _____ days.
13. Provide adequate number of durable garbage containers or receptacles which are properly sealed within _____ days.
14. Provide house number which can be plainly observed from the street within _____ days.

Remarks/Other: _____ _____

_____ _____

III. VIOLATIONS CHECKED BELOW REFERRED FOR ACTION:

1. Open or improper storage and junk	Zoning Inspection	5. Junk or abandoned motor vehicle	Litter Control
2. Horse/livestock	Zoning Inspection	6. Sidewalk Obstruction	Street and Sanitation Service
3. Potentially hazardous electrical conditions	Electrical Inspection	7. Other: _____	
4. Substandard structures	Urban Rehabilitation		

Department: _____ _____
Signature of Owner/Agent/Person-in-Control

Inspector: _____ Inspector's Phone No. _____

This notice is in accordance with existing City Ordinances and you are requested to comply by correcting the above described violation(s) within indicated number of days of receipt AND THEREAFTER MAINTAIN PREMISES, ADJACENT ALLEY AND PARKWAY free of all violations. (See reverse side of this notice for further explanation).

2.37

Figure 2.2
(continued)

EXPLANATION OF NOTICE OF VIOLATION

1. All land areas shall be kept clean at all times. They shall be kept free from all combustible waste, sources of insect, rodent, or vermin breeding, harborage, and infestation, trash and debris. Generally, the occupant of the property is held responsible even though he may be renting. (Section 27-24) (Section 27-28) (Section 16-12-15) (Section 19-17) (Section 18-12).

2. The term "dangerously exposed" shall mean the placing of an icebox or refrigerator not in use in a garage, barn, outbuilding, porch, yard, lot of other portion of premises where children at play may come upon it and be attracted to it. (Section 31-13).

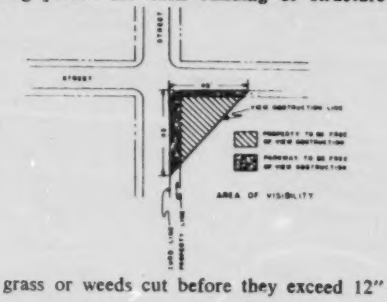
3. Any person storing or keeping upon or in any premises or lot, lumber, timber, or firewood, shall pile such lumber, timber, or firewood in a neat orderly pile not to exceed 6' in height, 5' from any building and property line, open racks and elevate not less than 18" above the ground and shall keep such piles or lumber, timber or firewood free from rubbish, grass, weeds or other combustible waste material. (Section 16-18).

4. No owner or person having charge or any unoccupied building or structure within the corporate limits of the City shall leave such building or structure unlocked, unboarded or otherwise unsecured so that unauthorized persons may enter the building or structure. (Section 16-71) (Section 27-91).

5. The owner, operator, or person-in-charge of dwellings or duplex units is hereby held responsible for the following requirements: Storage of flammable liquids other than fuel oil, shall be prohibited; except, that which is required for maintenance or equipment operation which shall not exceed 10 gallons. Such flammable liquid shall be stored in metal closed containers or safety cans. (Section 16-119) (Section 16-15).

6. No person, firm, or corporation shall erect, construct, enlarge, alter, repair, move, improve, remove, convert, or demolish any building or structure in the city, or cause the same to be done, without first obtaining a separate building permit for each building or structure from the Building Official.

7. On any corner lot, a fence, hedge, tree, or growth of any nature so erected, planted, or maintained so as to interfere with visibility between 2½ feet and 8 feet above the top of the roadway or curb with a triangular area formed by the intersection of the adjacent curb lines 45 feet as regards public traffic on the streets. The obstruction shall be removed on written notice from the City. (Section 24-403) (Section 27-27).



8. The owner/agent/person-in-control (normally the occupant), is responsible for having tall grass or weeds cut before they exceed 12" in height. (Section 18-13-18) (Section 16-70) (Section 27-27).

9. All land areas, improved and unimproved, shall be reasonably free from holes and excavations, sharp protrusions, and other objects or conditions which might be a potential cause of personal injury. Walks, steps, and driveways that contain holes or other hazards shall be filled, repaired, or replaced as the need indicates. All wells, cesspools, or cisterns shall be securely closed. (Section 27-33) (Section 16-62-63) (Section 16-70) (Section 19-92-93).

10. Discharge of sewage shall not be permitted upon the surface of the ground. Furthermore, water shall be properly drained to prevent recurrent or excessive ponding. (Section 27-25).

11. It shall be unlawful for the occupant or owner of any premises in the City or the agent or the owner to permit any collection of standing or flowing water in which mosquitoes breed, or are likely to breed, in such premises, unless such collection of water is treated in the manner prescribed by the City Ordinances. (Section 19-30-31).

12. Domestic animals and pets shall not be kept on any premises in such manner so as to create unsanitary conditions or constitute a nuisance. Domestic animals and pets shall be maintained in accordance with applicable regulations of the City of Dallas. Unsanitary conditions, inappropriate types of pets or animals and excessive numbers of same constitute conditions which may be considered a nuisance under this section. (Section 27-29) (Section 7-20).

13. Every person occupying a residence or duplex and every owner of an apartment shall provide such premises with a sufficient number of solid waste containers or receptables. These garbage containers or receptables shall be watertight and constructed of a solid and durable grade of metal or plastic. These containers or receptables so be equipped with tight fitting lids or secured at the top to prevent spillage. (Section 18-3-6).

14. Each owner, agent of the owner or the occupant of any house situated in the city shall place or permit to be placed thereon in some conspicious place on such house an official house number, so that the number may be plainly seen and observed from the street. (Section 43-99)

IMPORTANT!

Notices of violation are issued so that a situation might be called to the attention of a person responsible for correction. Ordinances of the city are intended to benefit the majority of the citizens and make our neighborhoods a better place in which to live.

Your cooperation and understanding will be sincerely appreciated.

ments, the Integrated Inspection staff and Data Services developed a computerized data system to avoid duplication of effort by numerous city inspectors. This program has resulted in considerable energy savings with respect to personnel and vehicles.

For further information, contact:

Jerry D. Morris
Integrated Inspection Supervisor
1500 West Mockingbird
Dallas, Texas 75235
Phone: (214) 630-1111 ext. 108

* * * * * * * *

Conservation Option: Codes for Alternate Energy Sources

Looking ahead to an increasing use of solar energy for both residential and commercial buildings, cities can act now to develop or adopt a code guiding solar energy applications. The first such municipal code was adopted in Pinellas, Florida; a Uniform Solar Energy Code (1976) is now available from the International Association of Plumbing and Mechanical Officials.

In addition to examining solar codes already in use by other communities, interested cities should read a concise summary of the legal and municipal planning issues involved in solar applications published by the University of New Mexico School of Law.

Information Sources:

"Construction Group Views Solar Code"
Houston Post, February 16, 1976, p. 10a

International Association of Plumbing and Mechanical Officials
Uniform Solar Energy Code
Los Angeles, California: International Association of Plumbing and Mechanical Officials, 1976

Melvin M. Eisenstadt and Albert E. Utton
Solar Rights and Their Effects on Solar Heating and Cooling
(Reprint from Natural Resources Journal)
The University of New Mexico School of Law
Albuquerque, New Mexico

* * * * * * * *

City of Houston
(pop. 1,341,000)

In late 1976, Houston amended its Uniform Building Code by ordinance to provide minimum standards for solar energy systems. Because of its uniqueness, that ordinance is repeated in full here.

AN ORDINANCE AMENDING THE BUILDING CODE OF THE CITY OF HOUSTON, TEXAS, BY ADDING A NEW CHAPTER, CHAPTER 88, REGULATING DIRECT SOLAR ENERGY APPLICATIONS, PROVIDING A SEVERABILITY CLAUSE, AND DECLARING AN EMERGENCY.

* * * *

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF HOUSTON:

Section 1. That the Building Code of the City of Houston is hereby amended by adding a new chapter, to be number Chapter 88, which said chapter reads as follows:

"Section 8801. SCOPE AND PURPOSE.

The purpose of this chapter is to provide minimum standards to safeguard life, limb, health, property and public welfare by regulating and controlling the design, construction, use, location and maintenance of all direct solar energy systems and the qualifications of those persons, firms, partnerships, or corporations permitted to install same in the City of Houston. This chapter applies to all active systems and all systems where solar energy is converted directly into electricity.

"Section 8802. DEFINITIONS.

ACTIVE SYSTEM - A solar heating or cooling system using circulated liquid, air or other fluid to transfer energy within a structure.

AIR HEATER - A solar collector using air rather than a liquid as the circulated heat transfer fluid.

COLLECTOR PLATE - The component of a solar collector which transfers the heat from solar energy to a circulating fluid.

CONCENTRATOR - A reflective surface or refracting lens for directing insolation onto the absorber surface.

COVER PLATE - A transparent plastic, glass plate or other material placed over the absorber plate of a solar collector to avoid heat losses and weathering of the absorber plate.

GLAZING - The cover glass for a solar collector.

INSOLATION - The total amount of solar energy reaching a surface per unit of time.

LANGLEY - Standard unit of insolation, 1 langley = 1 cal/cm^2
(1 langley/min. = 221 BTU/hr./$ft.^2$)

PACKED BED STORAGE - Heat capacity storage in a bed of packed solid material, usually rock.

PEBBLE BED STORAGE - Synonymous with packed-bed storage.

PERSON - Shall mean and include any person, corporation, partnership or association.

PHOTOVOLTAIC CONVERSION - Use of semi-conductor or other photovoltaic device which converts solar radiation directly to electricity.

RETROFIT - The addition of solar heating, cooling or hot water heating equipment to an existing structure to aid or replace the original non-solar system.

SOLAR COLLECTOR - Any device or assembly of components which collects solar energy and uses such energy directly or transforms it to another usable form of energy.

SOLAR CONSTANT - The insolation on a surface in space at the Earth's distance from the Sun, 428 BTU/hr/ft^2 (1.94 langleys/min).

SOLAR ENERGY - For the purpose of this chapter, the radiant energy of the sun in the forms of direct, diffuse or reflected radiation.

SOLAR ENERGY SYSTEM - Any system using solar energy as defined above.

SOLAR MEDIUM - The material in an assembly used for storing solar energy in its transformed state, be it thermal or electrical.

SUPPLEMENTAL ENERGY - The use of fuel or electricity to provide additional energy whenever solar energy cannot satisfy the demand.

"Section 8804.

No person shall install or alter equipment for any solar energy system unless he has obtained a permit therefor from the Building Official; provided, however, that no permit shall be required to install or alter a solar energy system solely to be used for research and not in any way to be used to provide energy for any domestic or commercial purposes. Use of energy to heat water used for swimming and use of energy in connection with a building or structure used for plants or animals shall be deemed to be a domestic or commercial use.

No owner, lessee, or other person having control over property shall permit the installation or alteration of a solar energy system on his property unless a permit for such has been obtained except where a permit is not required under this chapter.

A permit to install or alter a solar energy system shall only be granted to:

1) A state-licensed master plumber who has complied with the requirements of Chapter 84 of the City of Houston Building Code if the system is to be used for water-heating and/or swimming pool heating.

2) A licensed electrician subject to the licensing requirements of Chapter 85 of the City of Houston Building Code if the system converts solar energy directly into electricity.

3) A licensed air-conditioning contractor subject to the licensing requirements of Chapter 89 of the City of Houston Building Code if the solar energy system is one other than those described in (1) and (2) above.

Provided, however, a property owner may obtain a permit to install or alter a solar energy system other than a system converting solar energy directly into electricity in a building occupied by the owner as his home, providing such work will be done by himself and will be done in full compliance with all applicable laws and ordinances.

The person to whom the permit is issued shall be responsible to see that all work authorized by the permit is done in compliance with the requirements of all applicable laws and ordinances.

To obtain a permit, the applicant shall file an application therefor in writing on a form furnished for that purpose. The applicant shall set forth:

1) Applicant's name.
2) Applicant's plumbing, electrical or air-conditioning contractor license number.
3) Street address or property description of the land on which the proposed work is to be done.
4) Name of the owner of the property on which the proposed work is to be done.
5) Valuation of proposed work.
6) Proposed use of the system.
7) Maximum BTU or equivalent in watts to be produced by the system.
8) Function system will fulfill, including a statement as to the minimum energy which will be produced by such system throughout a year.

The applicant shall submit two (2) sets of plans and specifications with each application in accordance with the requirements of Chapter 4 of this Code.

The application, plans and specifications filed by an applicant for a permit shall be checked by the Building Official. Such plans may be reviewed by other departments of the City to check compliance with the laws and ordinances under their jurisdiction. The Building Official shall issue a permit to the applicant if he finds that the work described in the application and the plans filed therewith conform to the requirements of this Code and all other pertinent laws and ordinances, the proposed solar energy system will function as claimed by the applicant, and the fees required in Chapter 59 of this Code have been paid. The issuance of a permit shall not constitute any form of a warranty to any person that the solar energy system will function as claimed by the applicant.

Such permit shall be posted at the site where such solar system is to be installed or altered prior to commencing the work authorized by

the permit and at all times until all required inspections by City of Houston officials have been made.

The burden shall be upon the applicant to submit sufficient evidence to prove that the materials and methods will conform to the requirements of this Code and all applicable laws and ordinances, and that the solar energy system will function as claimed by the applicant.

If tests are necessary to determine whether the materials or methods conform to the requirements of this Code and all applicable laws and ordinances and/or that the solar energy application will function as claimed by the applicant, such tests shall be made at the expense of the applicant. The tests to be made shall be described in writing by the applicant. Both the tests and the person performing the tests shall be approved by the Building Official. A test shall be approved by the Building Official if it is designed to accurately reflect whether or not the material or methods meet the requirements of this Code and all applicable laws and ordinances, and whether or not the system will function as claimed by the applicant. The Building Official shall approve the person making the test if the Building Official finds such person has the physical and technological capacity to perform the tests unless it is shown that such person has submitted inaccurate test results of a serious nature to any City official or City Board in the past. The burden shall be on the applicant to show that the test is accurate and the person conducting the test is qualified.

All materials and methods individually approved by the Building Official shall bear the manufacturer's label or otherwise be clearly identified when used within the City of Houston so that they can easily and readily be identified by the City's inspectors.

"Section 8805.

If the Building Official denies a permit for a solar energy application, the applicant may appeal the decision of the Building Official to the appropriate City Board (hereafter referred to as Board) as set out below:

For appeals regarding water heating and swimming pool heating systems, appeal may be made to the Plumbing Review Board.

For appeals regarding systems converting solar energy directly into electricity, appeal may be made to the Electrical Board.

For appeals regarding the application of Section 2302-Loads, Section 2305-Roofs, Section 2308-Wind Loads, Chapter 34-Skylights, Chapter 36-Penthouse and Roof Structures, Chapter 52-Plastics, and/or Chapter 54-Glass and Glazing, appeal may be made to the General Appeals Board.

For appeals regarding all other applications of solar energy, appeal may be made to the Air Conditioning Board.

APPEAL PROCEDURES:

An appeal from a decision of the Building Official denying a permit to install or alter a solar energy system shall be made by petition

to the appropriate Board as set out above, such petition to be mailed or delivered to the Board's Secretary, c/o Building Inspection Division, Public Works Department, City of Houston, City Hall Annex, Houston, Texas, 77002. Such petition shall set forth the name of the person who applied for the permit, the date the application was made, the street address or property description of the land on which the proposed work is to be done, the specific reasons why the petitioner believes the decision of the Building Official should be modified or reversed, the section numbers of the applicable Code provisions, and specific authority, if any, that would tend to substantiate the petitioner's position. The petitioner shall indicate in such petition whether or not he wishes an oral hearing before the Board.

If the petitioner has requested an oral hearing before the Board, such hearing shall be set within six (6) weeks of the date the petition is received by the Building Inspection Division. The petitioner shall be notified of the date, time and place where such hearing will be held, that the petitioner may appear in person and/or be represented by an attorney and that he may present testimony, cross-examine all witnesses, and present oral and/or written argument. Such notification shall be sent at least five (5) days prior to the hearing to the petitioner by certified mail, return receipt requested. All hearings by the Board shall be public and shall be conducted under rules consistent with the nature of the proceeding; provided, however, the formal rules of evidence applicable to judicial proceedings are not required.

The burden shall be on the petitioner to show that the decision of the Building Official should be modified or reversed.

The Board shall have the power to affirm, modify or reverse any decision of the Building Official. The Board shall make its determination whether to affirm, modify or reverse the decision of the Building Official on the basis of whether or not the decision of the Building Official complies with the standards set out in this chapter. All Board decisions shall be in writing, a copy of which shall be forwarded by United States mail to the appealing party.

If the Board finds that it is impractical to conduct adequate tests prior to installation of the solar energy system, the Board shall give tentative approval and permission to make the installation or use of a material or method of sufficient evidence is submitted to show that such installation or use will not create conditions dangerous to human life.

However, no tentative approval shall be granted if the Board finds that the materials and/or methods will not, in fact, meet the requirements of the Code or other applicable laws and ordinances or will not function as claimed by the applicant.

When the Board grants tentative approval and permission to make the installation or use of the material or method pending results of tests to be made to determine whether or not the material or method meets the requirements of this Code and all applicable laws and ordinances, and functions as claimed by the applicant, such approval shall be evidenced by a permit which shall generally describe the method or material for which tentative approval has been given, the location of the proposed installation, the name of the agency which will conduct the

tests required, and shall specify the date on or before which the results of such tests shall be submitted to the Board. A copy of the permit shall be conspicuously posted at the location of the installation.

In the event the tests fail to prove that the item meets the requirements of this Code, all applicable laws and ordinances, and that the system will function as claimed by the applicant, the applicant who was granted tentative approval shall be so notified in writing by the Board and the permit authorizing installation shall be revoked unless the system is made to comply with the requirements of this Code, all applicable laws and ordinances, and is made to function as claimed.

"Section 8805. GENERAL REQUIREMENTS.

(a) All plumbing, electrical, heating, air conditioning and refrigeration work performed in connection with the installation or alteration of a solar energy system must be done by persons authorized to do such work under the provisions of this Code regulating the respective work, and all such work must be done in compliance with all applicable provisions of this Building Code.

(b) All solar energy installations must be designed and constructed to meet all requirements of this Building Code, and all ordinances of the City of Houston including, but not limited to, the requirements of Section 2302-Loads, 2305-Roofs and 2308-Wind Loads, Chapter 34-Skylights, Chapter 36-Penthouse and Roof Structures, and must be glazed to meet the requirements of Chapter 52-Plastics and Chapter 54-Glass and Glazing.

(c) All provisions of this Building Code requiring permits, inspections and approval of plumbing, electrical, heating, air conditioning, refrigeration and any other specific work are fully applicable when such work is done in connection with the installation or alteration of a solar energy system.

(d) Collector boxes and their supporting structures shall be of a fireproof material or shall have been treated with an approved fire resistive material if the collectors and their supporting structures are on a building over 50 feet high or if they are in Fire Zones 1 or 2.

"Section 8806. RELIEF VALVE REQUIREMENTS AND METHOD OF RATING.

(a) Any portion of a solar energy system, containing a solar energy collector, and using a fluid other than air, shall have a relief valve to protect that portion that can be isolated by valves or is otherwise subject to constraint of the liquid. The relief valve shall be set at or below the safe working pressure of the collector.

(b) The maximum rating for solar collectors shall be 442 BTU/FT^2/HR (2 langleys/min) based on gross face area of the collector. This rating is only for the purpose of computing the proper rating for pressure relief valves for collectors.

"Section 8807. HEATING SYSTEMS FOR FLUIDS.

(a) Water:

1. Potable water shall be protected against cross connections

as per Section 84-1204 of this Code. All other water systems may be directly connected to collector plates or other heat sources.

2. Collectors are to be built for minimum of 125 psi safe working pressure and 160°F if they are directly connected to the City water main.

3. A hydrostatic test pressure of one and one-half times the safe working pressure shall be required for collectors that are to be directly connected to the City water main. All collectors using a liquid shall be so tested.

(b) Solutions and Fluids Other Than Water:

Potable water heating systems utilizing solutions of fluids other than water as the heat producing media shall be protected from cross connections by the use of an approved device. The potable water system shall be protected in accordance with Section 84-1204 of this Code in the potable makeup line. In the alternative, two heat exchange devices may be connected with an intermediate circulating loop containing potable quality water.

(c) Air to Air Systems:

1. Solar systems utilizing a heat source containing noxious fumes and serving an occupied area shall employ a heat exchanger constructed of suitable, approved non-corrodible material. Such systems shall maintain an absolute pressure in the secondary side higher than in the primary side.

2. In all other systems, the air may circulate directly from the heat source to the area being supplied with energy.

3. Packed bed storage arrangements shall be well drained.

"Section 8808. INTERPRETATION OF CHAPTER 88.

1. The Plumbing Review Board shall have authority to interpret this Chapter insofar as it relates to systems using solar energy for the heating of water.

2. The Electrical Board shall have the authority to interpret this Chapter insofar as it relates to systems converting solar energy directly into electricity.

3. The Air Conditioning Board shall have the authority to interpret the Chapter as it relates to all applications of solar energy other than those set out in 1 and 2 above.

Section 3. If any provision, section, subsection, sentence, clause or phrase of this ordinance, or the application of same to any person or set of circumstances is for any reason held to be unconstitutional, void or invalid, the validity of the remaining portions of this ordinance or their application to other persons or sets of circumstances shall not be affected thereby, it being the intent of the City Council in adopting this ordinance, that no portion thereof or provision or regulation contained herein, shall become inoperative or fail by reason of any unconstitutionality of any other portion hereof and all provisions of this ordinance are declared to be

severable for that purpose.

Section 3. There exists a public emergency requiring that this ordinance be passed finally on the date of its introduction, and the Mayor having in writing declared the existence of such emergency and requested such passage, this ordinance shall be passed finally on the date of its introduction, this the 9th day of November, 1976, and shall take effect immediately upon its passage and approval by the Mayor.

PASSED this 9th day of November, 1976.

APPROVED this 9th day of November, 1976.

For further information, contact:

Wallace Payne
Building Inspection Department
P.O. Box 1562
Houston, Texas 77001
Phone: (713) 222-4556

* * * * * * * *

Conservation Option: Financial Evaluation of Conservation Opportunities

Many conservation opportunities produce significant energy/cost savings with little or no investment, e.g., turning lights out, adjusting thermostat settings, etc. For those techniques that require a capital investment, however, it is important that city officials be able to analyze the project costs vs. benefits simply because local governments do not have unlimited funds to implement every "good idea" that comes along.

The National Bureau of Standards (NBS) has compiled a comprehensive list of financial evaluation procedures that can help city administrators analyze the value of capital outlay conservation techniques. While these procedures take into account many decision factors, NBS emphasizes that each user must also include the specific jurisdiction's individual preferences and/or limits in reaching a final decision - factors including willingness to take risks, taxation patterns, and preference for short- or long-term investments.

The concept of life-cycle costing has already been discussed under purchasing in this manual section. Examples of other NBS-suggested evaluation tools include:

I. First Level Measures of Performance - useful for initial screening of ideas, but cannot alone justify major conservation investments. Required data for these measures are:
   - First Cost (FC) - estimated dollar cost of materials and labor to implement the technique; disregard salvage value
   - Annual Operating Costs (AOC)
   - Annual Fuel Savings (AFS)
   - Projected Fuel Price (PFP) - an average price during the estimated life of the investment.
   - Estimated Lifetime (EL)
   - Using this data,

$$\text{Net Annual Savings (S)} = (\text{AFS} \times \text{PFP}) - \text{AOC}$$

First Level Measures:

- Payback Period (PP) - compare to EL of investment for a rough judgement as to the potential for recouping project expenditures

$$PP = \frac{FC}{(AFS \times PFP) - AOC} \quad \text{or} \quad \frac{FC}{S}$$

- Return on Investment (ROI) - takes into account the depletion of an investment over its life through a depreciation factor; puts investments with different ELs on a comparable basis

$$\text{Straight Line Depreciation Charge (DC)} = \frac{FC}{EL}$$

$$ROI, \%/yr = \frac{S-DC}{FC} \times 100\%$$

Where the rate of return appears small, use second level measurements.

II. Second Level Measures of Performance incorporate an allowance for the time value of money, usually through a discount factor. Discount rates vary widely and are an administrative decision. The level chosen, however, can affect the range of conservation techniques acceptable for investment by either eliminating all but the very few highly "profitable" projects or by permitting too many relatively ineffective techniques with minor savings.

- Benefit/Cost Analysis (B/C) - compares present value (discounted) benefits or savings of a project with its costs. B/C greater than one implies that the investment will be profitable.

  A table of present worth factors (PWF), included here as Figure 2.3, greatly simplifies B/C calculation. Using the appropriate discount rate for the city (D) and EL for the project, the user can calculate the present value of S as follows:

$$PV = S \times PWF$$

The formula for B/C is then:

$$B/C = \frac{PV}{FC}$$

Figure 2.3

PRESENT WORTH FACTORS (PWF)

LIFETIME (EL)	DISCOUNT RATE (D)				
	5%	10%	15%	20%	25%
1	0.952	0.909	0.870	0.833	0.800
2	1.895	1.736	1.626	1.528	1.440
3	2.723	2.487	2.283	2.106	1.952
4	3.546	3.170	2.855	2.589	2.362
5	4.329	3.791	3.352	2.991	2.689
6	5.076	4.355	3.784	3.326	2.951
7	5.786	4.868	4.160	3.605	3.161
8	6.463	5.335	4.487	3.837	3.329
9	7.108	5.759	4.772	4.031	3.463
10	7.722	6.145	5.019	4.192	3.571
11	8.306	6.495	5.234	4.327	3.656
12	8.863	6.814	5.241	4.439	3.725
13	9.394	7.103	5.583	4.533	3.780
14	9.899	7.367	5.724	4.611	3.824
15	10.380	7.606	5.847	4.675	3.859
16	10.383	7.824	5.954	4.730	3.887
17	11.274	8.022	6.047	4.775	3.910
18	11.690	8.201	6.128	4.812	3.928
19	12.085	8.365	6.198	4.843	3.942
20	12.462	8.514	6.259	4.870	3.954
21	12.821	8.649	6.312	4.891	3.963
22	13.163	8.772	6.359	4.909	3.970
23	13.489	8.883	6.399	4.925	3.976
24	13.799	8.985	6.434	4.937	3.981
25	14.094	9.077	6.464	4.948	3.985

Example: Calculating a Benefit/Cost Ratio

Given: D = 20%
EL = 10 years
S = $27,500 annually

From Figure 2.3, PWF = 4.192

Therefore, PV = S x PWF
= $27,500 x 4.192
= $115,280

and $B/C = \frac{PV}{FC} = \frac{\$115,280}{\$100,000}$ or 1.15

Since B/C is greater than one, the investment appears profitable based on the discount rate used.

- Time to Recoup Investment or Breakeven Period (BP) - similar to PP, but considers discount rates.

  BP can be approximated using Figure 2.3 and the PP as calculated in first level measures. Locate the city's discount rate D; read vertically down that column until you locate the figures on either side of the project's calculated PP. The BP will be between those two years.

Example: Calculating the Breakeven Period

Given: PP = 3.6 year
D = 20%

From Figure 2.3, the figures on either side of 3.6 are 3.326 and 3.605. These are PWF for EL's of 6 and 7 years respectively.

Therefore, BP is between 6 and 7 years; interpolation would produce a closer approximation.

- Internal Rate of Return (IRR) - the discount rate D which reduces the stream of net returns associated with the investment to a present value of zero. The IRR on the best available investment option is generally considered to be the appropriate D for evaluating other new investments unless this D is below the true finance rate. The measure is best used in evaluating a project with a fixed first cost followed by a stream of positive net benefits. Like B/C, IRR is useful when comparing expected rates of return for alternative investments.

  IRR calculation is best estimated by a computerized financial analysis program as it involves an iterative approach converging on the solution.

For financial personnel familiar with economic price theory, marginal analysis can be used to determine the "optimal" level of investment (in terms of net savings) for conservation techniques whose rates of return decrease as the levels of investment increase (ex., insulation). This optimal level will occur where

MS = MC

given: MS = marginal savings (present value savings generated by the last increment of the project)

MC = marginal cost (present value cost of the last increment)

For a complete discussion of MC and MS, consult any basic economics or price theory text.

Information Sources:

U.S. Department of Commerce
National Bureau of Standards
Energy Conservation Program Guide for Industry and Commerce,
pp. 5-1 - 5-5
Washington, D.C.: U.S. Government Printing Office, 1974

Conservation Option: Periodic Energy Reports

In order for city administrators to stay informed about energy usage in municipal services, it is important to establish some type of regular energy reporting system. Such a system gives management the basic data it needs for control, planning, and budgeting as well as providing a foundation for evaluation of conservation program effectiveness over an extended time period. In addition, reporting requirements insure that those who compile the figures and forward the results are regularly reminded of energy use in their area of responsibility.

* * * * * * * *

City of Lufkin
(pop. 28,500)

Lufkin routinely audits monthly electric bills for its various city departments, storing data on units used and dollar costs in their computer. When the Municipal Civic Center was completed, its energy usage was added to the overall record.

Later, the usual analysis of that facility's bill drew the attention of city administrators. Over a several month period, usage and charges seemed excessively high. Working with the local utility to discover why, it was found that a wiring mixup was causing energy used to run through the meter twice. The large overbilling that resulted was subsequently refunded to the city.

For further information, contact:

Royal Dunlap
Assistant City Manager
P.O. Drawer 190
Lufkin, Texas 75901
Phone: (713) 634-8881

* * * * * * * *

The complexity of data reported and type of system used should be geared to the needs and abilities of personnel involved. At a departmental or lower level, a simple table of monthly unit and dollar energy expenditures may be quite effective. The same data plotted on a chart and hung in a prominent place can remind employees of the need to keep an eye on energy waste.

When such reports from all city departments are combined for the given period, administrators get a quick overview of the magnitude of energy expenditures required for city operation. Examined separately and compared with reports from previous time periods, departmental reports can reveal opportunities for conservation, pockets of waste, and individual commitment to city conservation goals by agency/department heads, supervisors, and other employees.

More sophisticated mathematical analysis - by computer if available - can produce trend data that will be of value to purchasing agents in predicting seasonal energy-product needs and in making their buying more efficient. Long-range conservation programs can be more carefully evaluated over their life as to costs, savings, unexpected problems, and their solutions. Data such as this, when shared with other communities of state energy research agencies, can greatly advance the "state-of-the-art" of conservation in cities.

Following are two simple examples of energy reports. Others will be found in manual sections dealing with specific topics, i.e., building audits and gasoline use in public vehicle fleets.

Information Sources:

U.S. Department of Commerce
Energy Management for Small Business (Mimeographed)

National Electrical Contractors Association and National Electrical Manufacturers Association
Total Energy Management, pp. 8-11
n.p.: National Electrical Contractors Association, 1976

Figure 2.4

Monthly Departmental/Agency Record of Energy Use and Expenditures

	ELECTRICITY		GAS		FUEL OIL		WATER	
	$	KWH	$	THERMS	$	GAL	$	GAL.CU FT
JAN								
FEB								
MAR								
APR								
MAY								
JUN								
JUL								
AUG								
SEPT								
OCT								
NOV								
DEC								

Source: U.S. Department of Commerce

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City of Cleburne
(pop. 21,000)

MONTHLY GASOLINE REPORT

MAY 1977

ADMINISTRATION	GALLONS	OIL (QT)	MILES	M.P.G.
1 - City Manager	116.6	0	1490	12,77
2 - Public Works	91.0	0	809	11.39
2a- Engineering	54.9	0		
3 - Water	96.0	0	911	9.48
5 - Health	66.0	1	544	8.24
6 - Inspection	48.0	0		
8 - Traffic Control	125.5	2	941	7.92
10 - Tax	60.7	0	783	12.89
14 - Housing	31.6	0	693	14.11
CEMENTARY	389.6	120		
DPW WAGONS	111.9	0		

MONTHLY GASOLINE REPORT
(continued)

ADMINISTRATION	GALLONS	OIL(QT)	MILES	M.P.G.
FIRE	564.2	2		
GOLF COURSE	0	0		
PARKS	481.8	11		
STREET	2664.8	106		
WAREHOUSE	191.7	0		
WATER DISTRIBUTION	740.8	7		
WATER TREATMENT	155.3	5		
WASTE WATER	56.0	4		
WASTE WATER COLLECTION	263.1	0		
POLICE				
Unit 11	590.4	9½	5073	8.59
Unit 12	390.0	4	3167	8.12
Unit 13	580.0	9½	4678	8.06
Unit 14	54.9	0	605	11.02
Unit 15	528.0	0	4546	8.60
Unit 16	135.0	2		
Unit 17	354.0	0	2796	7.89
Unit 19	120.5	0	1183	9.81
Unit 20	102.8	0	1073	10.43
Unit 21	9.1	0	114	12.52
Unit 22	702.2	8½	6479	9.22
Boat	16.0	1		
TOTAL FOR POLICE	3583.4	34½		
TOTAL FOR CITY HALL	6309.5	258		
TOTAL FOR POLICE & CITY HALL	9892.9	292½		

Source:

Lloyd Moss
City Manager
P.O. Box 657
Cleburne, Texas 76032
Phone: (817) 645-2457

* * * * * * * *

Conservation Option: Project/Technique Evaluation Reports

The importance of project evaluation to the effectiveness of any city conservation effort cannot be denied. Evaluation reports - periodic for on-going efforts and a summary for those completed - permit a more exact analysis of program results. They can also be very effective in demonstrating the value of conservation efforts to elected city officials and the citizenry at large.

The complexity and detail of such reports depends, again, on the needs of the city involved. Some type of written evaluation on each conservation technique implemented is recommended, however, as a means of ensuring thoughtful analysis and for future referral in evaluating overall city conservation efforts.

The two-page project evaluation summary in Figure 2.5 was developed for industry and commerce. It could, however, be easily adapted to individual city needs.

Information Source:

U.S. Department of Commerce
National Bureau of Standards
Energy Conservation Program Guide for Industry and Commerce,
pp. 2-46 and 2-47
Washington, D.C.: U.S. Government Printing Office, 1974

Conservation Option: Energy Cost Projections

In order to more effectively plan and budget for future energy expenditures, some type of cost projections for basic energy supplies are needed. Such projections are difficult to make because of the uncertainty in energy markets and national policy affecting supply/demand factors. However, even a cautious estimate of future costs in the city's jurisdiction is a better management guide than relying solely on current prices.

Example: Purchasing Department Energy Cost Projections

A U.S. Departmert of Commerce publication suggests a memo to appropriate personnel (energy coordinator, department heads) with the following

Figure 2.5

ENERGY CONSERVATION PROJECT
EVALUATION SUMMARY

Capital_____or Expense_____

Department _____

Date _____

Project No._____ Person Responsible _____

Project Title: _____

Description of Project: _____

_____

_____

_____

_____

Location: _____

Financial Evaluation

Estimated

Energy saving (electric power kWh/yr - steam lb/yr,etc.)

Utility or Raw Material	Saving
_____	_____/yr
_____	_____/yr
_____	_____/yr
Total Energy saving	_____MBtu/yr
Total Energy cost saving	_____$/yr
Other cost saving due to:	
_____	_____$/yr
Additional cost due to:	
_____	_____$/yr
Net cost saving	_____$/yr
Cost of Project	_____$

Figure 2.5
(continued)

ENERGY CONSERVATION PROJECT
EVALUATION SUMMARY

Calculated

Return on investment _____ %
Pay back period _____ months
Other _____ _____

Btu/unit of production: Now _____ After project implemented _____

Benefits/Problems

Product quality _____
Product yield _____
Production rate _____
Safety _____
Pollution _____
Maintenance-manpower/materials _____
Utilities _____
Working conditions _____
Employee attitude _____
Community _____

Other benefits/problems connected with implementation:

_____
_____
_____

Comments: _____

_____

Project rating: _____

_____

_____

Planned authorization request date: _____

information:

	Cost at present	Estimated cost 3 Years	5 Years
Electric Power	$____/KWH	$____/KWH	$____/KWH
Natural Gas	$____/1000 cu.ft.	$____/1000 cu.ft.	$____/1000 cu.ft.
Fuel Oil	$____/gal	$____/gal	$____/gal
Coal	$____/ton	$____/ton	$____/ton

In his discussion of life cycle costing (see purchasing options), however, Tether warns that purchasing department projections for LCC use may end up in court, protested by suppliers whose projects have been rejected on the basis of future operating costs. He suggests that it may be wiser to use present area energy prices in this case. For many other planning efforts, however, some realistic estimate of future costs is essential.

Information Sources:

U.S. Department of Commerce
National Bureau of Standards
Energy Conservation Program Guide for Industry and Commerce, pp. 2-20
Washington, D.C.: U.S. Government Printing Office, 1974

Ivan J. Tether
"Purchasing Strategies for Reducing the Direct Consumption of Energy", pp. 26-27
ECP Report September 1975
(Newsletter of the Energy Conservation Project, Environmental Law Institute)

Employee Participation

Conservation Option: Employee Advisory Committees

It is essential that employees be well-informed about the city's internal conservation program in order to gain their support and participation in its activities. One way of keeping employees up-to-date on the latest city conservation plans and insuring their feedback on problems and new ideas is through an Employee Advisory Committee (EAC).

In a city with a designated Energy Coordinator, the EAC would include that person and a representative from each municipal department. Committee members could serve as an evaluation team for on-going conservation plans as well as participating in the selection of new techniques. Another major function of the EAC would be information dissemination to other city employees, either through a regular newsletter or departmental conservation meetings/programs. The EAC could also evaluate employee suggestions to improve energy efficiency in city operations and present awards to winners of in-house conservation contests.

The Federal Energy Administration identified the following benefits of an EAC to a city in its conservation programming:

- More ideas generated
- Increased employee commitment to the success of the program
- Better information dissemination to employees through word-of-mouth
- Improved conservation planning through the involvement of those who will be affected
- Better acceptance of conservation programs with unpleasant or unpopular tasks

Information Source:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, p. 21
Washington, D.C.: U.S. Government Printing Office, 1976

Conservation Option: Employee Education and Awareness Programs

A city cannot expect significant changes in energy-wasteful habits un-

less its employees are fully aware of the energy problem, its seriousness, and the need for conservation. Effective communication of the city's reliance on costly energy-based products coupled with some calculations of the savings - both in energy and taxpayer dollars - of even minor acts like turning off lights are the basis for a successful effort.

Several techniques are recommended for employee education and awareness programs. One or more meetings, workshops, or seminars to introduce a new conservation thrust can provide background information about national/international energy use, budget expenditures for energy in the city, and the outline of city conservation plans. Expert speakers for such a program are commonly found in universities, local utility public relations departments, and through the state energy office. Particularly interesting are "how-to-save-money-and-energy" brochures published by federal/state energy agencies and various audio-visual programs available free of charge from the educational services division of larger utilities.

Employee newsletters published on a regular basis by many cities are excellent for keeping everyone informed about the success/failure of on-going city conservation programs. They can introduce the program in conjunction with the initial seminar and keep it "visible" with follow-up articles on savings achieved, new developments in energy conservation technology, and reports by the city's Energy Coordinator and/or Employee Advisory Committee.

Example: Baltimore's Conservo-Gram and Conservation Memoranda

To emphasize conservation news, the City of Baltimore uses a special newsletter - the "Conservo-Gram" - which can be posted and distributed to approximately 40,000 city employees every two weeks. Each newsletter is printed on a different colored stock so employees will recognize and read every new issue.

In addition, Conservation Memoranda containing guidelines for operational implementation of city efforts are issued to agency heads and other employees with administrative responsibilities. These memoranda have addressed the following topics: program overview, city building energy measures, the "Waste Watcher" program, water conservation measures, employee suggestion system, lighting conservation, fuel conservation, air conditioning, recycling of textile products, postage and mailing practices, use of photocopiers, and reusable cartons.

Colorful posters, signs, and other inexpensive printed reminders can also be effective in changing employee habits when displayed prominently and frequently. Many cities across the nation have used this communication device, as shown by the following examples from Baltimore and Austin.

Light Switch Reminders

Turn Me Off

When I'm not Needed

Austin, Texas

Baltimore, Maryland

Information Sources:

City of Austin
Energy Conservation Commission
Assorted conservation materials

S. D. Zemansky
City Purchasing Agent
Baltimore, Maryland
Assorted conservation materials

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 22-23
Washington, D.C.: U.S. Government Printing Office, 1976

City of Port Arthur
Memorandum to City Manager on Energy Conservation
December 10, 1973

Conservation Option: Employee Suggestion Award Programs

To encourage the participation of employees in conservation efforts, a city may wish to conduct formally recognized and rewarded competitive programs. Whether a one-time contest or monthly selection of the best conservation idea, such efforts can generate employee enthusiasm while providing real on-the-job savings.

Example: Mecklenburg County, North Carolina: Two-Week Employee Conservation Contest

For a two-week period kicking off the County's energy program, county employees were encouraged to submit their suggestions for energy conservation. Extensive publicity for the contest - through the local news media, county news, and special posters - produced over one hundred suggestions. The County Employees Energy Committee selected the winners; prizes ($100 for first place) were presented at an official County Commissioners meeting.

Example: Baltimore's Improvement Suggestion System and Employee Incentive Awards

In 1975, the City of Baltimore established a system of monetary incentive for conservation suggestions to stimulate and encourage city employee participation in city conservation efforts. To be eligible for a cash award, a suggestion must produce a net savings of $250 or more for the first full year after implementation. Those ideas that are implemented are then sub-

mitted to an Incentive Awards Board which determines the appropriate award amount, not to exceed 10% of the amount saved. Employees are presented certificates in addition to the cash award, and their photographs are used in posters encouraging further suggestions.

Excerpts from the formal policy establishing this program follow:

POLICY:

It is the policy of the City to actively solicit improvement suggestions that will conserve the City's resources, increase efficiency, or other wise reduce costs from its employees and to give formal consideration to these suggestions. When appropriate, the City will provide monetary awards or other forms of recognition for those successfully applied suggestions which substantially benefit the City.

* * *

RESPONSIBILITIES:

The Office of the Comptroller is responsible for the overall supervision of this policy and for reporting resultant cash awards, made to eligible employees by the Incentive Awards Board, to the Board of Estimates. The Incentive Awards Board shall review and if appropriate approve all recommendations from the Conservation Program Office for monetary awards based on tangible monetary savings and establish the appropriate amount of any monetary award to be made for suggestions adopted that will result in significant intangible benefits to the City. The Conservation Program Office is responsible for the receipt, recording and evaluation of all suggestions submitted. Each suggestion shall be acknowledged and the suggestor advised of the disposition of the suggestion by the Conservation Program Office. The Conservation Program Director will submit only those Improvement Suggestions that have been adopted and implemented to the Incentive Awards Board for final review. The Conservation Program Director shall also assure the full coordination of the Improvement Suggestion System activities and publicity with related projects such as materials standardization, work simplification, industrial health and safety programs.

* * *

ELIGIBILITY:

All employees of the Mayor and City Council of Baltimore, whether full or part-time are eligible to submit suggestions. Agency, department and Bureau heads, and employees whose job responsibilities call for them to seek methods to improve

operations or services shall not be eligible for cash awards. Supervisory personnel will not receive cash awards for suggestions which deal with operations under their own supervision or assigned general responsibility, but supervisors may receive cash awards for suggestions that deal with operations other than those under their supervision or assigned general responsibility.

* * *

FORM OF SUBMITTAL:

For suggestions to be considered, they must be submitted in writing on the Improvement Suggestion Form. Verbal suggestions cannot be given any consideration. Unsigned suggestions will not be considered, but a suggestion may be processed anonymously if the suggestor so desires and indicates.

* * *

GROUP SUGGESTIONS:

It may be necessary for several persons to collaborate in the preparation and submission of a suggestion. If such a suggestion is adopted and implemented, any resultant cash award will be divided between the suggestors whose names appeared on the Improvement Suggestion Form in the percentages determined by the suggestors prior to submission of the suggestion. If no percentage determination is indicated by the suggestors, the Incentive Awards Board shall assume that all parties contributed equally and apportion any resultant cash award accordingly.

* * *

DUPLICATE AND REJECTED SUGGESTIONS:

Duplicate suggestions cannot be given consideration for cash awards. The Improvement Suggestion Form must be dated prior to submission. If duplicate suggestions are dated on the same day, the first one received and opened shall be considered the original and shall be the only one eligible for award.

* * *

DETERMINATION OF AWARD:

In order to be eligible for a cash award, a suggestion with tangible benefits must result in at least $250.00 in projected savings during the first year. Awards for adopted suggestions with tangible monetary benefits will at the option of the Incentive Awards Board be based on a percentage of the projected first year's savings of $250.00 or more. The amount

of savings will be calculated on the basis of estimated net monetary benefits, after implementation costs have been subtracted, for the first full year of operation following adoption or implementation of the particular suggestion.

* * *

For the purposes of determining the amount of cash award for adopted suggestions with measurable tangible benefits, computations shall be made on the basis of actual or estimated savings in the form of: (a) Actual dollar savings in terms of labor hours or personnel requirements; (b) Increased productivity at the same costs; or (c) Savings in specified materials or other resources. Prior to the making of any cash award for suggestions adopted with measurable tangible benefits the estimated dollar savings shall be validated by the Department of Audits.

* * *

AWARD SCHEDULE:

When the adoption and implementation of an Improvement Suggestion having tangible benefits results in measurable net monetary savings, for the first full year of operation, of $250.00 or more the amount of the award shall not exceed 10% of the amount saved. The amount of the cash award shall be established by the Incentive Awards Board.

* * *

FUNDING:

No funds will be required for Improvement Suggestion Awards. Cash awards will primarily be made for those Improvement Suggestions that have been adopted which result in actual dollar savings. These awards should be funded out of the budget of the agency that will gain the benefits of the savings. Awards made for adopted Improvement Suggestions that have significant intangible benefits should be made out of the funds available within the affected agency. If the Improvement Suggestion is to be adopted and implemented on a City-wide basis the costs of implementation and resultant cash award should be charged against the budgets of the agencies deriving the greatest benefits on a prorata basis.

* * *

Information Sources:

City of Baltimore
Conservation Memorandum No. 7
September 10, 1975

Mecklenburg County, North Carolina
Mecklenburg County Energy Conservation Program Interim Report, p. 9
Charlotte, North Carolina

Conservation Option: Give Employees Administrative Conservation Duties

In an attempt to involve as many employees as possible in municipal conservation programming, several cities have assigned employees limited administrative duties. These employees see that techniques are properly carried out, collect information for the central energy office, and answer conservation questions from their fellow workers. As noted earlier, they may also review new conservation plans or employee suggestions.

Example: "Waste Watchers"

With some 40,000 municipal employees, the City of Baltimore has developed a system of "Waste Watchers" to guard against wasteful practices and aid in their elimination. Some 1,000 city employees from every office, shop, warehouse, garage, school, and other city facility make up this group. Their duties include receiving and disseminating all conservation memoranda and directives in their area of responsibility as well as encouraging conservation suggestions by other employees.

Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, p. 21
Washington, D.C.: U.S. Government Printing Office, 1976

City of Baltimore
"Developing a Conservation Program", October 18, 1976
Baltimore, Maryland

Conservation Option: Employee Ride-Sharing

A vast amount of information exists on the "why's" and "how's" of

various ride-sharing programs - carpools, vanpools, special bus services, etc. Most of the successful programs have been supported either by large private enterprises specifically for their own employees or by federal funds in demonstration projects covering entire communities - public and private employees alike.

Details of these efforts will be examined in the manual section on transportation systems. It is important to note here, however, that local governments can help reduce their employees' transportation cost, increase their morale, and reinforce the "conservation ethic" by promoting various ride-sharing options. Even simple programs such as giving parking lot priority to city employees who use daily car pools emphasize the importance of employee participation in all-around conservation efforts.

* * * * * * * *

City of University Park
(pop. 23,498)

Many employees of University Park live outside city boundaries and, therefore, must travel considerable distances to and from work. To lessen the increasing cost impact of this travel, University Park has tried to match up employees and arrange their work hours to permit carpooling wherever possible. This informal program was started long before the oil embargo and requires very little administrative effort, yet it has been useful in retaining good employees who might otherwise seek jobs closer to home.
For further information, contact:

Leland Nelson
City Manager
P.O. Box 8005
Dallas, Texas 75205
Phone: (214) 363-1644

* * * * * * * *

Conservation Option: City Council Support for Energy Conservation

City conservation planning often has two thrusts - one directed inwardly at governmental operations and the other directed outwardly toward the private sector and the community at large. It is vital to the success of both these thrusts that local elected officials publicly take notice of the energy problem and support city conservation efforts in all areas.

Several Texas cities responded to the 1973 oil embargo with council resolutions outlining basic problems and delegating responsibility for their analysis and solution. The following resolution from San Antonio is an example.

* * * * * * * *

City of San Antonio
(pop. 800,000)

A RESOLUTION
ON THE ENERGY CRISIS
73-29-29

WHEREAS, the recent energy crisis in San Antonio has made all our citizens come to the realization that the time has come for some serious thinking and planning not only for the immediate needs of our area, but also for the long-range acquisitions of our sources of energy. The same proposition also applies to our future supplies of water, NOW, THEREFORE:

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF SAN ANTONIO:

SECTION 1. The City Council wants to assure all our citizens that it will continue to exert energy effort to provide not only solutions to our present, immediate crisis, but also to secure adequate and dependable future sources of gas or fuel oil, to meet our residential and industrial demands.

SECTION 2. That the City Council expects the City Public Service Board to bring to this Council, as soon as possible, a plan seeking to prevent a future recurrence of the recent power shortage. This would even extend to other sources of energy still in the

experimental stage. Another possibility would be for the CPSB to acquire and develop, for its exclusive use, new gas sources.

SECTION 3. That the City Council expects the City Public Service Board to recover for the citizens of San Antonio, any costs incurred in the purchase of fuel oil, over and above the cost that it would have ordinarily paid for the gas it had contracted with Coastal States Gas. And furthermore, that when these funds are recovered, either by negotiation or by litigation, that they be returned to the customers of CPSB in the form of reduced utility bills for a specified period of time.

SECTION 4. That the City Council request the City Public Service Board to appear before this Council as soon as possible to brief us on their plan to recover from Coastal States Gas whatever damages it deems the citizens of San Antonio are entitled to on account of the recent curtailment of natural gas.

SECTION 5. That the City Council instruct the City Manager to prepare and implement a program of energy conservation measures in all municipal operations, and that it encourage all citizens of San Antonio to continue to conserve gas and electricity as much as possible from now on.

SECTION 6. That the San Antonio Police Department be prepared and ready to implement any measures it deems necessary, in case crime or burglary or automobile accidents should take a serious upturn due to any measure taken to conserve energy.

SECTION 7. This City Council has become aware that the City Public Service Board is considering making a commitment to participate in a nuclear power plant by July 1, which, in effect, may commit the Council to this project. The City Council has not received any official communication about this proposed participation in a nuclear power plant and desires to know the details of it.

SECTION 8. That the City Council hold a public hearing on Friday, June 15, 1973, at 9:00 A.M. in the Council Chamber at City Hall to discuss with the City Public Service Board the items outlined in this resolution.

PASSED AND APPROVED this 7th day of June, 1973.

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While embargo "crisis" problems have ended, it is still important to have official recognition of the value and need for conservation efforts from the local governing body. Such recognition not only encourages municipal employees to seriously tackle energy waste but also opens the

way to active, productive community involvement. As Mark Twain once said, "Few things are harder to put up with than the annoyance of a good example."

Information Source:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, p. 5
Washington, D.C.: U.S. Government Printing Office, 1976

Conservation Option: Citizen Energy Conservation Committee

Committees of interested citizens can serve two important purposes in a community trying to implement a comprehensive energy conservation plan: (1) as an outreach program to the citizenry at large, and (2) as an advisory board to the city on its internal plans.

As an outreach program to fellow citizens, such a committee can be very effective in developing and disseminating conservation information directed at every aspect of community life. Members of the committee could make presentations to other interested groups, emphasizing both the city's efforts to reduce its internal energy use and the importance of conservation at home and on the road. The committee could also work with local schools and public libraries to promote conservation poster or slogan contests with winning entries reprinted and hung in public buildings.

As an advisory committee to the city's internal conservation efforts, citizens can bring to municipal energy problems a variety of outlooks and expertise that may result in new, innovative programs. Possible duties for such citizen conservation committee would be the investigation of new techniques to conserve energy, prioritizing of options for action, and the development of local ordinances to implement good ideas.

Ideally, a citizen energy conservation committee would combine these functions to serve as a focal point for community conservation. Only two Texas cities responding to this survey, however, currently have any sort of citizens committee. Both, interestingly, are very active, involved groups that have made significant contributions to local government conservation efforts.

* * * * * * * *

City of Lake Jackson
(pop. 19,000)

Lake Jackson's committee was only established early in 1977, but already it has conducted an audit of existing city facilities and made recommendations for energy-related improvements. In addition, committee members participate in planning for new municipal construction with an eye to energy savings. The secret of this group's success? A membership of interested citizens, many having professional expertise in energy areas (including engineers from the local Dow Chemical facility).
For further information, contact:

A. A. Mac Lean
City Manager
103 Parking Way
Lake Jackson, Texas 77566
Phone: (713) 297-2481

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City of Austin
(pop, 308,087)

Austin has had a 21 member Energy Conservation Commission since early 1974 which has been particularly active in preparing ordinances for approval by the City Council. The Commission does not limit itself to making suggestions for action. Rather, it does the background research, holds public hearings, and works with legal advisors to produce a complete ordinance document for Council consideration. As a result of this dedication, the Commission has seen its ordinances or recommendations on the following topics become law: minimum insulation standards for frame structures, increased insulation requirements for duct work and steam condensate pipe, annual municipal Christmas lighting programs, a city contingency plan, minimum energy efficiency ratios, and individual metering of dwelling units.

The Committee itself was formed by means of the following ordinance:

ORDINANCE NO. 74 0117-A

AN ORDINANCE CREATING AN ENERGY CONSERVATION COMMISSION AND PROVIDING FUNCTIONS FOR SAID COMMISSION; SUSPENDING THE RULE REQUIRING THE READING OF ORDINANCES ON THREE SEPARATE DAYS; AND

DECLARING AN EMERGENCY.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF AUSTIN:

PART 1:

(a) There is hereby created a commission to be known as the Energy Conservation Commission of the City of Austin. The Energy Conservation Commission shall be composed of twenty-one persons appointed by the city council. One of the members shall be designated chairman by the city council.

(b) The members of the Energy Conservation Commission shall serve for a term of three years, provided, however, that seven of the original members of the Energy Conservation Commission shall serve for a term of one year, and seven of the original members shall serve a term of two years, and the remaining seven original members shall serve three year terms. At the first meeting of the Energy Conservation Commission, lots shall be drawn to determine each member's term. Applicable terms shall expire on January 31 of the appropriate year, provided, however, for the purpose of determining the expiration date of the terms of the original members of the Energy Conservation Commission, January 31st, 1974, shall not be counted as an anniversary date and no term shall expire on said date.

(c) The function of the Energy Conservation Commission shall be to maintain an overview of all programs, studies and proposals concerning the use and conservation of energy and to advise the city council on energy matters.

(d) The Energy Conservation Commission shall have an Executive Board. The Executive Board shall be composed of the chairman of the Energy Conservation Commission and six other Commission members appointed to the Executive Board by the city council. The chairman of the Energy Conservation Commission shall also serve as chairman of the Executive Board.

(e) The chairman of the Executive Board shall coordinate all activities of the Commission and the Executive Board and shall particularly concern himself with study, review and consideration of short term energy conservation techniques, methods, plans, and/or proposals.

(f) Initially, the Energy Conservation Commission shall have the following standing committees:

(1) Committee on Transportation.

(2) Committee on Education and Media.

(3) Committee on Electrical Code and Performance Levels.

(4) Committee on Building Codes.

The chairman of the Executive Board shall appoint a member of the Board to chair the Transportation, Education and Media, and Electrical Code and Performance Levels Committees. No member of the Board shall chair more than one committee. Three members of the Board shall jointly chair the Committee on Building Codes. The chairman of each standing committee shall determine the members and size of his committee, provided, however, committee members shall be selected from members of the Energy Conservation Commission or other citizens who indicate a desire to serve on that particular standing committee.

(g) Upon majority vote, the Executive Board may define, redefine, expand or limit the scope or responsibility of any committee.

PART 2. WHEREAS, an emergency is apparent for the immediate preservation of order, health, safety and general welfare of the public, which emergency requires the suspension of the rule providing for the reading of an ordinance on three separate days, and requires that this Ordinance become effective immediately upon its passage; therefore, the rule requiring the reading on three separate days is hereby suspended and this Ordinance shall become effective immediately upon its passage as provided by the Charter of the City of Austin.

PASSED AND APPROVED

January 17, 1974

For further information, contact:

Pieter Sybesma
Research and Budget Division
P.O. Box 1088
Austin, Texas 78767
Phone: (512) 477-6511, Ext. 2240

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Information Source:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 5-6
Washington, D.C.: U.S. Government Printing Office, 1976

Conservation Option: Community Information

Cities have several opportunities to disseminate conservation information to their citizens. Articles in local newspapers, brochures in utility bills, collections in public libraries, and posters, signs, or bumperstickers emphasizing conservation are all possibilities. Ideas on the following pages are from various departments or agencies of the Austin City government.

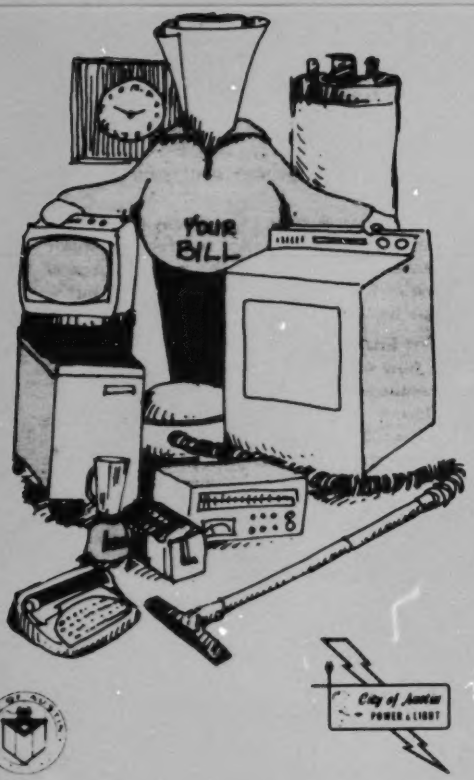
Be A Watt-Watcher

Control Your Consumption

- Keep your thermostat set at 78 degrees.
- When you leave home for more than 4 hours, turn off the air conditioner.
- Close off all unused space.
- Weatherstrip windows and doors.
- Have your air conditioning system or units inspected and serviced. Keep filters clean.

save money
save energy

Watt-Watcher's Guide To Energy Consumption



ENERGY IN THE CITY ENVIRONMENT. *Rickles.*
An overall view of energy problems with appended summaries of desirable short and long term conservation measures. B 333.82/Ri

GETTING THE MOST FOR YOUR MONEY *Scaduto.*
Efficiency=Economy! Tips on purchasing electrical appliances to achieve both.
640.73/Sc

350 WAYS TO SAVE ENERGY AND MONEY IN YOUR HOME AND CAR.
Several experts combine talents in this illustrated volume to provide practical, understandable energy conservation tips including home heating, insulation, ventilation, operation of appliances, etc.
B 333.82/Th

HOW TO COOL YOUR HOUSE. *Sunset.*
Proper siting for your home, selection of efficient cooling units--even placement of shade trees can minimize energy use and utility costs. 697.93/Su

THE USER'S GUIDE TO THE PROTECTION OF THE ENVIRONMENT. *Swatek.*
Charts outlining estimated use and average yearly kilowatt consumption are interspersed with environmentally sound suggestions to cut electric use in the home. 640.73/Sw

THE DO-IT-YOURSELF ENVIRONMENTAL HANDBOOK. *Koestner, ed.*
Costs and wattage charts covering everything from a light bulb to a heat pump are highlighted in this book's chapter entitled "Conservation in Your Home." B 333.72/Ko

THE AUSTIN PUBLIC LIBRARY

Watt-Watcher's
Guide
to
Insulation

From Your
City of Austin **Electric Utility Department**

Information Source:

City of Austin
Energy Conservation Commission
Assorted Conservation Materials

Miscellaneous Options

Conservation Option: Relaxing Dress Codes

With the emphasis on reducing the amount of energy used for year-round comfort conditioning in buildings, cities can help realize important short term savings by relaxing traditional dress codes in working areas. A memo advising warmer clothing in the winter and cooler dress in the summer (open collars for men) can ease adjustment to the new temperatures, reduce employee complaints, and promote the city's "energy conservative" image.

Conservation Option: Shortened Lunch Breaks

Reducing the lunch period to thirty minutes can have several benefits. First, it may encourage "brown bagging" and save the fuel normally spent in going home or away from the office for lunch. Second, it shortens the work day, allowing building electrical systems to be shut down earlier. Finally, the earlier release time may mean that employees miss heavier rush-hour traffic and conserve their own automobile fuel.

Conservation Option: Prohibit Electric Space Heaters

Portable space heaters consume large amounts of energy and generally benefit only a very few employees. Such heaters can be hazardous and, in fact, may be in violation of local safety codes. Employees should be advised to dress more warmly rather than use this equipment. If complaints persist, appropriate personnel should be assigned to examine the regular heating system for problems.

Conservation Option: Telephone vs. Travel

Wherever possible, employees should be encouraged to telephone or write instead of driving for professional visits. Such a policy saves gas and may be greatly appreciated by the busy professional at the other end of the line.

Conservation Option: Holiday Schedules

Rescheduling holidays into long weekends has been a recent trend. Besides providing a longer continuous leisure period for employees, energy savings result from shutting down building heating systems for a long period rather than intermittently during the week.

Conservation Option: Flexible Working Hours

Flexible working hours were developed in response to the growing discontent of many workers with their jobs as expressed through high turnover, excessive absenteeism, and static or reduced productivity. Basically, "flexitime" refers to a working day with two types of time: core and flexible. During core time, all employees must be present. Flexible periods are those parts of the scheduled work day within which each employee may choose his/her own time of arrival and departure from work. There are two basic requirements for a flexitime system: (1) the employee must be present during core hours, and (2) each employee must account for the total number of required hours each day.

Flexitime schedules vary widely. Most commonly, flexible periods may be from 6:30-9:30 a.m. and 3:00-6:00 p.m., with core time from 9:30-3:00 p.m. It is also possible to arrange for flexible hours at the beginning, middle, and end of the day with core time split into two sections. Further variations include flexible time within the span of a single week or a single month.

The U.S. Civil Service Commission booklet on flexitime presents details on advantages/disadvantages of this system and steps in its implementation. For this discussion, we will point out only that energy overhead costs (heat, lights, etc., in buildings) may actually increase because of the extended hours each day. However, from an overall energy consumption standpoint - and as an important factor in worker morale - the increase in overhead energy use may be offset by the decline in fuel consumption realized as workers spend less time on congested highways traveling to and from work.

Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 5-7
Washington, D.C.: U.S. Government Printing Office, 1976

Broward County, Florida
Packet of conservation materials
June 1977

U.S. Civil Service Commission
Flexitime, pp. 4-7
Washington, D.C.: U.S. Government Printing Office, n.d.

III Public Buildings

III: Public Buildings

Building Site and Envelope

Conservation Option: Site Selection/Orientation for New Buildings

The careful selection of a site is an important factor in the energy use level of a new public building. Each geographical area of the state has a general set of climatic conditions; the specific site for a new building will either increase or decrease that climate's impact on energy consumption in the structure.

In chosing a site, the General Services Administration makes the following recommendations:

- Select a site with year-round ambient wet and dry bulb temperatures somewhat lower than those desired within the structure's occupied spaces
- Select a site with high air quality to maximize natural ventilation
- A site should allow optimum building orientation and configuration to minimize total annual energy consumption
- Select a site with topographical features or adjacent structures to provide desirable shading and wind breaks
- Select a site to reduce unwanted heat reflections from nearby bodies of water

Site selection in the southwest is particularly important in reducing heavy energy use for air conditioning. In general, new buildings should be sited and oriented so as to minimize solar loads on windows, walls, and roofs in the summer. Roof surfaces that face south, however, facilitate the use of solar heating/cooling systems.

Information Sources:

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 3-1, 4-1
Washington, D.C.: U.S. Government Printing Office, 1977

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, pp. 36-37
Washington, D.C.: Public Technology, Inc., 1975

Conservation Option: Site Development for New Buildings

Once a site is selected, its natural resources can be used to reduce over-all energy demand for the new building. The General Services Administration suggests the following ideas:

- On a sloping site, partially bury the building or use earth berms to reduce solar radiation
- Ponds around the building can be used to reduce ambient outdoor temperature
- Collect rainwater for use in the building (if needed) and for care of the landscape

Information Source:

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 4-1 - 2
Washington, D.C.: U.S. Government Printing Office, 1977

Conservation Option: Landscaping New and Existing Buildings

Two landscape factors are frequently noted in the literature for their impact on building energy consumption: vegetation and pavement areas.

In considering trees and shrubs for landscaping, choice will necessarily be limited by the area's climate and soil conditions. Sufficient types and numbers of plants can, however, be found for any area to provide some conservation advantages in terms of shade or windbreaks. Three common suggestions for vegetation in landscape follow:

- Deciduous trees should be planted for their summer shading and windbreak effect for buildings up to three stories in height. Such trees lose their leaves in the winter, allowing the sun to warm walls and interiors through windows.
- Coniferous trees provide sun shading and windbreaks year-round.
- Exterior walls/roofs covered by vegetation or earth can also reduce heat transmission. However, certain plants may harm the building's exterior and should be avoided. The concept of earth-covered buildings will be examined in more detail later in this section.

The location and size of paved areas, type of surface, and solar angle all have substantial effects on the heat load of a building's first two or

three floors. Shrubs or lawn areas between the building and sidewalks - or between a sidewalk and a street - will help reduce heat build-up in the surrounding area. Shading walls and paved areas next to buildings also reduces the indoor/outdoor temperature difference. A concrete (light) paved area to the south of a building will reflect light onto its surface; an asphalt (dark) area will absorb sunlight but radiate heat.

Paved areas, whether for employee parking or service/delivery, are necessary to all buildings. Their impact on energy consumption can be reducen by consolidating or relocating such areas and/or shading their surfaces to the extent possible.

Information Source:

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 4-1 - 4-3, and Energy Conservation Guidelines for Existing Office Buildings, 2nd ed., pp. 2-1 - 2-3
Washington, D.C.: U.S. Government Printing Office, 1977

Conservation Option: Building Configuration

Closely tied to the issue of orientation is building configuration. The smaller the exposed surface area, the lower the heat transmission for a given enclosed volume. A spherical or round building has the least exposed surface area of any shape; a square building has less surface than a rectangular structure of equal floor area. The number of stories also modifies this relationship, as do the following factors identified by the General Services Administration:

- Overall building height
- Floor-to-floor height
- Floor-to-ceiling height
- Ceiling plenum height
- Roofs
- Exposed floors
- Building forms
- Zig-zag walls

Information Source:

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 5-1 - 5-5
Washington, D.C.: U.S. Government Printing Office, 1977

Conservation Option: Innovative Designs: Earth Covered Buildings

Some of man's earliest homes were caves; the modern equivalent - earth covered buildings - is an idea just catching on in many countries. Structures built totally or partially underground provide many advantages: minimal environmental damage, surface space preservation, protection from weather and noise, and a more aesthetic landscape.

Most important to this study, however, are the real and significant energy savings offered by this idea. Temperatures below ground are relatively constant and moderate, offering a dramatic reduction in heating and cooling energy expenditures. The earth itself acts as an insulator, not only for temperature but also noise.

* * * * * * * *

University of Houston
Student Center

In the early 70's, the University of Houston realized it had outgrown its existing student center and required new facilities to meet the needs of some 27,000 students, 90% of whom were commuters. With limited open space available and a desire to preserve as much of that as possible for future use, Harry A. Golemon designed an award-winning underground addition to the old center. The addition houses many activities, including a lounge, snack bar, crafts studios, and student association offices. Linked underground to the sunken courtyard of the old building, the new addition's roof is a landscaped area suitable for rallies and concerts. (pp. 131-134)

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Information Source:

Frank L. Moreland, ed.
Alternatives in Energy Conservation: The Earth-Covered Buildings
Arlington, Texas: University of Texas at Arlington, 1975

Conservation Option: Envelope Energy Indices (EEI) for Texas

The Texas State Building Commission published an energy conservation

manual in 1976 for use by designers, builders, and contractors of nonresidential buildings. Concerning the building envelope, this manual recommends maximum energy requirements in BTU's per gross interior square feet of floor area per year. EEI are intended to serve as guidelines to determining the energy efficiency of a building still in the design stage.

EEI include temperature and solar climate influences, but not internal loads. The sample "energy budgets" in Figure 3.1 are based on a square building with the number of floors corresponding to the most efficient building configuration.

Climatogical data charts and instructions for calculating a particular building envelope index are included in the Texas State Building Commission manual, pp. 67-87.

Information Source:

State of Texas Building Commission
Energy Conservation Manual, Part 2: Apartment and Nonresidential Buildings, pp. 11-15
Austin, Texas. June 1976

Conservation Option: Exterior Opaque Walls

Exterior opaque walls have several functions: support, protection of interior areas, reduction of heat flow in and out, release of internal air pressure variations, etc. Because of these, opaque walls also present real opportunities for conservation - especially in the design of new public buildings. Six major areas for consideration are:

- Wall Mass - Affects heat transmission from exterior to interior. An existing wall of large mass has high thermal inertia which modifies the "U" value effect on heat transmission; i.e., a wall with high thermal inertia takes longer to transfer exterior heat to the interior than one of the same "U" value but low thermal inertia. In areas with long, hot summers, large thermal inertia should have a high priority for conservation.
- Wall "U" Value - should be selected after consideration of summer and winter design temperatures. Generally, the lowest "U" values are most effective for conservation.
- Thermal Insulation - should be chosen in keeping with its location, desired "R" value, and concern for moisture protection. Ideally, insulation should be located outside the mass of the building - not only outside a wall section but

Figure 3.1

ENVELOPE ENERGY INDICES (EEI)
BTU PER SQ FT/YR FOR STATE OF TEXAS

(values given in thousands)

CITIES	BUILDING SIZE (GROSS SQUARE FEET)							
	6,250	12,500	25,000	50,000	100,000	200,000	400,000	800,000
AMARILLO	51.3	40.4	32.4	25.3	19.9	15.8	12.5	9.9
AUSTIN, SAN ANTONIO	51.9	41.3	32.7	25.6	20.4	16.1	12.8	10.1
BROWNSVILLE	57.7	46.0	36.3	28.5	22.8	17.9	14.2	11.3
CORPUS CHRISTI	54.7	43.7	34.3	27.0	21.7	17.0	13.5	10.7
DALLAS, FORT WORTH	53.9	42.8	34.0	26.6	21.2	16.7	13.2	10.5
DEL RIO	54.2	43.1	34.1	26.8	21.3	16.8	13.4	10.6
EL PASO	46.2	36.7	29.0	22.8	18.1	14.3	11.3	9.0
GALVESTON	45.4	36.5	28.2	22.4	18.1	14.1	11.1	8.8
HOUSTON	48.9	38.9	30.7	24.1	19.2	15.1	12.0	9.5
LAREDO	59.3	47.2	37.4	29.3	23.4	18.4	14.6	11.6
LUBBOCK	48.4	38.3	30.4	23.8	18.9	14.9	11.8	9.4
MIDLAND	49.3	39.2	21.0	24.3	19.4	15.2	12.1	9.6
SAN ANGELO	52.1	41.4	32.8	25.7	20.5	16.1	12.8	10.1
TYLER	51.0	40.6	32.1	25.2	20.0	15.8	12.5	9.9
WACO	53.3	42.3	33.5	27.7	22.0	17.3	13.8	10.9
WICHITA FALLS	56.1	44.5	35.3	27.7	22.0	17.3	13.8	10.9

outside the structure itself - to reduce air leakage and heat loss. As noted earlier in the section on ASHRAE 90-75, insulation should be selected by its "R" or resistance value. While resistance is directly proportional to thickness, adding insulation thickness results in diminishing returns. Careful calculations should be made to determine the point of maximum economy and conservation. Proper wall venting and use of vapor barriers will prevent moisture condensation.

- Still Air Film - on a building's exterior also helps reduce heat loss and gain. Protective coatings, textured surfaces and vines can maintain a film; each, however, has disadvantages that must be considered. While grilles, fins, and screens are frequently added to existing structures for sun shading, they also can be effective in maintaining the still air film.
- Wall Color - can be planned to help control solar heat gains. Light colors decrease solar gain on exterior walls; dark colors increase it. High reflectivity is another option in hot climates.
- Earth Berms - covering at least part of the building wall can save energy. Such berms are most effective in areas of extreme temperatures, extreme solar gains, and high winds.

Information Sources:

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 5-12 - 5-16, and Energy Conservation Guidelines for Existing Office Buildings, 2nd ed., pp. 3-4 - 3-10
Washington, D.C.: U.S. Government Printing Office, 1977

Conservation Option: Glass Walls, Windows, and Doors

Glass areas can add greatly to the beauty of a building and the comfort of its occupants. However, because heat transmission is much greater through glass than through opaque walls, the following conservation ideas should be considered:

- Minimize the ratio of glass wall/window area to opaque wall area and/or square footage. ASHRAE 90-75 and other thermal standards specify allowable glass area.
- Use double or triple glazing or insulated glass. Reflective surfaces can also be very helpful in the Texas summer; they will, however, reduce natural light and useful heat in winter. Such considerations must be carefully balanced.

- In hot climates, minimize exposed glazing on south walls.
- Avoid window frames that form a thermal heat transfer bridge between interior and exterior.
- Shading glass areas is extremely important, particularly during hot summer months. Shading can be accomplished in many ways, but external devices are more effective. Awnings, overhangs, fins, solar screens, and deciduous trees are examples of exterior shading; draperies, shades, and venetian blinds are used inside.

Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 57-58
Washington, D.C.: U.S. Government Printing Office, 1976

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 5-16 - 5-19; and Energy Conservation Guidelines for Existing Office Buildings, 2nd ed., pp. 3-10 - 3-17
Washington, D.C.: U.S. Government Printing Office, 1977

Conservation Option: Roofs

As a major part of the building envelope, roofs also offer conservation opportunities. Heat transmission through the roof can be reduced by the following options:

- Increased insulation
- Reflective surface
- Roof spray
- Roof pond
- Sod and planting on roof
- Equipment and equipment rooms located on roof
- Double roof with ventilation space between
- Solar shading for roof surfaces

A roof slope that faces south will gain heat. While this is not beneficial in the south, it should be considered if solar heating/cooling systems are feasible. Dark roofs with high absorptivity will gain heat; light colored roofs with high reflectance will minimize heat gain.

Information Source:

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 5-11 - 5-12
Washington, D.C.: U.S. Government Printing Office, 1977

Conservation Option: Infiltration

Outdoor air entering a building through cracks, joints, pores, improperly sealed windows, and open doors places an extra load on heating and cooling energy consumption. This infiltration can be minimized by:

- Impermeable external surface materials
- Sealing and weatherstripping cracks around doors and windows
- Locating building entrances and ventilation louvers on downwind side
- Provide windbreaks, vestibules and/or revolving doors at entrances
- Seal all vertical shafts

Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 59 and 63
Washington, D.C.: U.S. Government Printing Office, 1976

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 5-17 - 5-19
Washington, D.C.: U.S. Government Printing Office, 1977

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City of Dallas
(pop, 844,000)

The importance of the exterior building considerations discussed thus far is made apparent in Dallas' published design standards for new public buildings:

General Considerations - Exterior

The Architect should employ careful site analysis to exploit the natural features available which may ultimately prove more efficient than simply minimizing the building's area-to-volume ratio. Passive design measures, such as the basic orientation, configuration and exposure patterns in concert with site develop-

ment and judicious selection of building materials, textures, colors and glazing establish the basic thermal characteristics of the building. Energy conservation is pretty much making the best of what you have to work with.

* * *

Design Criteria

The Architect shall as a minimum comply with ASHRAE Standard 90 and the City of Dallas Codes while placing special emphasis on the criteria, standards and guidelines contained in this standard.

The City of Dallas is proposing a goal of limiting total energy expenditure for building operation to 40,000 BTU/gross square foot/year, recognizing that such a goal is ambitious and may be easier to attain in larger buildings than in smaller buildings. Given our advantageous climatic location, increased use of insulation and other energy conservation measures, we believe such a goal to be both attainable and realistic in most buildings.

* * *

Roof/Ceilings

The combined thermal transmittance value (U_o) for the gross roof area, including skylights, enclosing conditioned spaces shall not exceed 0.05.

Walls

The combined thermal transmittance value (U_o) for the gross area of exterior walls consisting of opaque wall areas, window areas, enclosing interior conditioned space, and including areas of foundation walls above grade that enclose conditioned space, shall not exceed 0.25.

* * *

Fenestration

All fenestration shall limit the maximum instantaneous combined solar and air to air heat transmission at design conditions to 70 BTU/HR./FT/^{2} for fenestration area. In building types such as libraries and recreation facilities or window areas that may be subjected to vandalism, no single glass shall exceed 16 sq. ft. in area.

This is for the purpose of limiting replacement costs resulting from vandalism. However, multiple lites not exceeding 16 sq. ft. each may be used in combination to create greater areas of glass.

Infiltration

Windows and storm windows shall be designed to limit air leakage into or from the building. The air infiltration rate for windows shall not exceed 0.5 cfm per foot of sash when tested at a differential pressure of 1.567 lb./sq. ft. which is equivalent to the impact pressure of a 25 mph wind (ASTM E 283-73).

Caulking and Sealants

Exterior joints around windows and door frames, between wall and foundations, between wall and roof, between wall panels, at penetrations of utility service through walls, floors and roofs, and all other openings in the exterior envelope shall be caulked, gasketed or otherwise weatherstripped.

For further information, refer to:

City of Dallas
Department of Building Services
Design Standards for Maintenance and Energy Conservation, pp. 1-3

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City of Jasper
(pop. 7,000)

When Jasper needed a new electrical warehouse, it decided on a typical metal structure with a 60 foot ceiling. Not so typical, however, was the decision on adjacent electrical department office space. Since not all the area in the building was needed for storage, a small office structure was added at one end inside the outer metal envelope. The entire building was insulated with regular batts; office walls were double insulated to conserve space heating/cooling energy. Because the office structure is only one floor in height, its roof is also used as storage space for regular warehouse inventory.

For further information, contact:

Wayne Dubose
City Manager
272 East Lamar
Jasper, Texas 75951
Phone: (713) 384-4651

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Conservation Option: Illumination Level Guidelines

Many factors must be considered when deciding on an appropriate - and energy conserving - level of lighting for a new or existing public building. Every building situation is different and requires individual analysis. In general, however, elements that should be taken into account include: acceptable cost, difficulty of tasks to be performed in specific areas, availability of daylight, design of task and surrounding area, lighting system spectral characteristics, glare, veiling and wall reflections, and the visual requirements of individual workers.

While there are no nationally accepted building illumination levels, several government and professional organizations have developed guidelines. The Federal Energy Administration and General Services Administration suggest a 50/30/10 standard for commercial buildings (offices, schools, warehouses, retail establishments): 50 footcandles (FC) at occupied work stations, 30 FC in work areas, and less than 10 FC in areas with minimal visual requirements. As an example, commonly used areas and FEA recommended FC levels are shown in Figure 3.2.

Figure 3.2
FEA Recommended Lighting Levels

Areas	Design Level (FC)	Range (FC)
Auditoriums	30	20 - 40
Cafeteria	30	20 - 40
Conference Rooms	30	25 - 35
Corridors, Lobbies and Means of Egress	15	10 - 18
Kitchen (Average)	50	30 - 70
Mechanical Rooms (General Areas)	10	5 - 15
Storage Areas (General Storage)	10	5 - 15
Storage Areas (Fine Details Required)	30	25 - 35
Toilets	20	15 - 30

Where task difficulty or employee visual requirements are unusually high, FEA suggests nonuniform supplemental lighting based on the data in Figures

Figure 3.3A

Relative visual task difficulty for common office tasks

Task Description	Visual Difficulty Rating
Large black object on white background.	1
Book or magazine, printed matter, 8 point type and larger	2
Typed original.	2
Ink writing (script).	3
Newspaper text.	4
Shorthand notes, ink.	4
Handwriting (script) in No. 2 pencil.	5
Shorthand notes, No. 3 pencil	6
Washed-out copy from copying machine.	7
Bookkeeping	8
Drafting.	8
Telephone directory	12
Typed carbon, fifth copy.	15

Figure 3.3B

Recommended maximum lighting levels

Task or area	Footcandle levels	How measured
Hallways or corridors.	10±5	Measured average, minimum 1 footcandle.
Work and circulation areas surrounding work stations	30±5	Measured average.
Normal office work, such as reading and writing (on task only), store shelves, and general display areas.	50±10	Measured at work station.
Prolonged office work which is somewhat difficult visually (on task only)	75±15	Measured at work station.
Prolonged office work which is visually difficult and critical in nature (on task only).	100±20	Measured at work station.
Industrial tasks	ANSI-A11.1-1973	At maximum.

The Illuminating Engineering Society (IES) has also developed illumination guidelines suggesting a minimum of 140-125 FC. While this standard has sometimes been criticized as too high, it is recommended by the Texas State Building Commission in its conservation manual. To guide the choice of

levels for specific tasks, the Building Commission also recommends a detailed task/watts per sq. ft. standard for maximum connected lighting loads developed by the American National Standard Institute, Inc. (ANSI). Below is an excerpt from that standard for office tasks:

	WATTS PER SQUARE FOOT Room Cavity Ratio	
TASK OR AREA	0 - 5	5+
Offices		
Drafting Rooms		
Detailed drafting, cartography	(200)	(200)
Rough layout drafting	5.0	6.0
Acounting offices		
Auditing, tabulating, bookeeping, business machine operation	5.0	6.0
General offices		
Reading poor reproductions, business machine operation, computer operation	5.0	6.0
Reading handwriting in hard pencil or on poor paper, reading fair reproductions, active filing, mail sorting	4.0	4.7
Reading handwriting in ink or medium pencil on good quality paper, intermittent filing	3.6	3.8
Private offices - same except:		
Reading high contrast or well printed materials	1.7	2.0
Conferring & interviewing	1.0	1.6

Information Sources:

Federal Energy Administration
Lighting and Thermal Operations: Guidelines, pp. 2-6
Washington, D.C.: U.S. Government Printing Office, 1975

State of Texas Building Commission
Energy Conservation Manual, Part 2: Apartment and Nonresidential Buildings, pp. 39-59
Austin, Texas. June 1976

General Services Administration
Energy Conservation Guidelines for Existing Office Buildings, 2nd ed., pp. 4-13 - 4-15
Washington, D.C.: U.S. Government Printing Office, 1977

Illuminating Engineering Society
IES Lighting Handbook, 5th ed., Figure 9-80
New York: Illuminating Engineering Society, 1972

Conservation Option: Efficient Lamps

The numerous light sources (lamps) on the market today have individual characteristics of color, life, physical size, and efficiency that should be considered in terms of the proposed application in a public building before purchase. Of special interest here is light source efficiency, measured in terms of light output (lumens) per unit of electrical input (watts). In general, energy efficiency increases with higher wattage even among light sources of the same type. Characteristics of the most common lamps are summarized in Figure 3.4 by the General Services Administration.

Figure 3.4

Characteristics of Typical Lamps (1)

Classification	Typical Size & Type	Color Index (CRI)	Range of Life, Hrs.	Efficiency(2) Lumens/Watt
Incandescent	40W, General Service	92	1,000-1,500	11
Incandescent	100W, General Service	89	750-1,000	22
Fluorescent	20W, 24-in.	55-75	9,000-15,000	50
Fluorescent	40W, 48-in.	55-75	12,000-20,000	70
Fluorescent	75W, 96-in.	55-75	12,000-20,000	73
High Intensity Discharge (HID)	400W, Coated Mercury	47-51	16,000-24,000	50
HID	400W, Metal Halide	53-72	12,000-18,000	77
HID	400W, High Pres. Sodium	21	12,000-18,000	100

(1) Information based on 5th Edition of IES Handbook and lamp manufacturer's latest data.

(2) Initial output including power required for auxiliaries.

Information Sources:

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 6-8 - 6-9
Washington, D.C.: U.S. Government Printing Office, 1977

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, p. 17
Washington, D.C.: Public Technology, Inc., 1975

Conservation Option: Relamping

The replacement of inefficient lighting systems in most existing public buildings would require significant capital expenditures. Important savings can, however, be realized at little cost by substituting more efficient lamps in existing fixtures.

Example:

CHANGE OFFICE LAMPS (2700 hours per year)		kwh	ENERGY SAVINGS/COST SAVINGS GJ*	3¢/kwh	5¢/kwh
from	*to*		*to save annually*		
1 300-watt incandescent	1 100-watt mercury vapor	486	5.25	$14.58	$ 24.30
2 200-watt incandescent	1 40-watt fluorescent	400	4.32	12.00	20.00
7 150-watt incandescent	1 150-watt sodium vapor	2360	25.5	70.80	118.00

*Gigajoule, an International System (SI) unit measuring power.

These suggestions result in roughly the same illumination levels but reduced energy consumption.

Information Sources:

Federal Energy Administration
Lighting and Thermal Operations: Guidelines, p. 5
Washington, D.C.: U.S. Government Printing Office, 1975

Craig B. Smith, ed.
Efficient Energy Use, p. 504
New York: Pergamon Press, Inc., 1976

Conservation Option: Delamping

Many organizations have conserved energy by reducing the overall number of lamps, particularly in hallways and storage areas. In removing fluorescent lamps from multi-lamp fixtures, it is important to remove all the lamps operated by the same ballast and disconnect the power to the ballast in order to realize full savings.

Delamping should be done carefully so as not to affect employee safety. Several Texas cities reported that delamping in stairwells had resulted in accidents, so that illumination levels were raised once again. It may be necessary to re-examine and amend safety codes to allow such a procedure.

Information Sources:

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, p. 18
Washington, D.C.: Public Technology, Inc. 1975

Craig B. Smith, ed.
Efficient Energy Use, p. 508
New York: Pergamon Press, Inc., 1976

Conservation Option: Colored Room Surfaces

The color of walls, ceilings, floors, and furnishings definitely affects the level of illumination in a room. Dark colored surfaces absorb light; light colors reflect light but may cause glare. The General Services Administration suggests that ceilings generally be finished in white (80-90% reflectance), walls be medium to light (50-80%), and floors be light medium to medium (20-50%). Figures are somewhat different from the Illuminating Engineering Society and American National Standards Institute: ceilings, 80-90%; walls, 40-60%; floors, 20-40%; and desk tops, furniture, and machines, 25-45%.

Example: Color Reflectance Values

Color	Reflective Value (%)	Color	Reflective Value (%)
White	82	Brown Tint	69
Light Gray	65	Light Brown	51
Medium Light Gray	50	Medium Light Brown	41
Medium Gray	35	Medium Brown	28

Color	Relfective Value (%)	Color	Reflective Value (%)
Medium Dark Gray	26	Medium Dark Brown	18
Dark Gray	14	Dark Brown	15
Blue Tint	68	Orange Tint	71
Light Blue	63	Light Orange	68
Medium Light Blue	49	Medium Light Orange	59
Medium Blue	39	Medium Orange	52
Medium Dark Blue	22	Medium Dark Orange	44
Dark Blue	8	Dark Orange	35
Aqua Tint	61	Red Tint	70
Light Aqua	48	Light Red	60
Medium Light Aqua	38	Medium Light Red	46
Medium Aqua	20	Medium Red	40
Medium Dark Aqua	13	Medium Dark Red	28
Dark Aqua	7	Dark Red	21
Green Tint	73	Laminated Plastic and Wood:	
Light Green	64		
Medium Light Green	55	White Bleached Grain	77
Medium Green	40	Maple	37
Medium Dark Green	25	Teak	17
Dark Green	12	Walnut	10
		Oak	9
Yellow Tint	78		
Light Yellow	75		
Medium Light Yellow	64	Miscellaneous:	
Medium Yellow	75	Green Chalkboard	15-20
Medium Dark Yellow	66		
Dark Yellow	54	Desk Tops	46-47

Source: Efficient Energy Use, p. 663

Information Sources:

Craig B. Smith, ed.
Efficient Energy Use, p. 663
New York: Pergamon Press, Inc., 1976

General Services Administration
Energy Conservation Guidelines for Existing Office Buildings, 2nd ed., p. 4-5
Washington, D.C.: U.S. Government Printing Office, 1977

Dallas Power and Light Company
"Getting More for Your Money from Lighting"
Public information brochure

Conservation Option: Multiple Switching and Automatic Controls

All of the lighting literature gathered for this manual recommends the use of multiple switching for maximum control of lighting systems. Such an option permits a more balanced use of lighting energy for the visual requirements of a specific task at a specific time and area. Thus, while an administrator might require 100 FC for detailed paperwork at a desk, lighting for a conference or conversation in the same area could be reduced with no effect on productivity. Generally speaking, large areas should not be under control of a single switch if turning off small sections of light would result in energy savings when areas are unoccupied.

Two problems exist in this area. First, it is true that frequent switching reduces the life of lamps, particularly fluorescent ones. If, however, a fluorescent lamp will not be needed for at least five to ten minutes, then the energy savings should generally offset the cost of shorter lamp life. For lamps with a warm-up period (ex., high intensity discharge), this time period should be considered in recommending switching guidelines to employees.

Secondly, it may be difficult to persuade employees to turn off unnecessary lights. This is primarily an educational problem requiring occasional reminders (memos, switchplate stickers) and an understanding of the potential savings involved.

Manual switching may not always be reliable. Automated systems can be precisely time controlled but generally represent a sizeable expenditure for equipment. For large areas, photocell switches can be used to integrate natural and artificial lighting more effectively. Time-clock switches in offices, toilets, storage, and equipment areas can be set for reasonable periods with manual overrides for occasional longer use.

The General Services Administration lists four suggestions for efficient switching:

- Install switches for lights near the windows so that the lights may be turned off in accordance with the amount of daylight available at a given time
- Luminaires should be selectively switched according to the possible grouping of working tasks at different working hours
- Use multiple lamp luminaires so that one or more lamps may be switched off during certain times of the day. Multiple ballasts or multi-level ballasts can be used for 3 or 4 lamp fluorescent luminaires to provide the appropriate levels of

illumination in accordance with the visual task requirements in an office space. Integral switches built on the luminaires are one of the most economical methods to accomplish selective switching without excessive wiring costs.

- Evaluate the use of low voltage (24 volts or lower) switching systems to obtain maximum switching capability

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City of Dallas
(pop. 844,000)

The design manual for Dallas public buildings addresses the issue of switching in detail as follows:

- Provide maximum flexibility in selecting any of several lighting of small areas by installing more control or switch points. Switches shall be provided on a minimum basis of one switch per 250 sq. ft. of floor area for buildings with less than 10,000 sq. ft. and one switch per 400 sq. ft. for buildings in excess of 10,000 sq. ft. of area. Control points for lights in the same area shall be separated as far apart as practical.
- Employ maximum use of manually selected time lapse switches in lieu of manual off/on switches for control of lighting circuits. In general, occupants should turn lights on and when conditions vary, the time lapse will turn lights off. All areas used less than 50% of the time, such as meeting rooms, closets, storage areas, etc., shall be equipped with manually selected time-lapse switches.
- Photo cells and time programs should be used to turn lights on-off for weekends and holidays

For further information, refer to:

City of Dallas
Department of Building Services
Design Standards for Maintenance and Energy Conservation, pp. 8-9

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Information Sources:

General Services Administration
Energy Conservation Guidelines for Existing Office Buildings, 2nd ed., pp. 4-18 - 4-18
Washington, D.C.: U.S. Government Printing Office, 1977

Federal Energy Administration
Lighting and Thermal Operations: Guidelines, p. 4
Washington, D.C.: U.S. Government Printing Office, 1975

Conservation Option: Exterior Building Lighting

Before the energy "crisis," exterior lighting was often lavishly used for decorative purposes. While this practice has declined, lighting remains one of the most effective means of security protection. The General Services Administration suggests certain guidelines for exterior security lighting, keeping in mind the need to conserve energy.

- Eliminate exterior lighting except where the lighting is to be used for the purpose of identifying the building entrances and egresses, and/or for security
- Consider intruder activated devices rather than photo-cell or time controlled illuminated security luminaires
- Coordinate street lighting with security lighting and eliminate duplication
- Use efficiency light sources (high pressure sodium or HID lamps)
- Use efficient luminaires (prismatically controlled lens, rather than general diffused, decorative geometric forms)
- Use photo-cell control for turning "on" exterior lights and time clock for turning "off" the exterior lights

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City of Moody
(pop. 1,500)

Moody's City Hall uses exterior flood lights for overnight security. The original system was manually operated, with an employee turning on exterior lights at the end of the workday and off the next morning. Such a practice meant that lights were frequently on during daylight hours, particularly over holidays and weekends. Also, it was easy to simply forget the lights in the bustle of leaving or arriving at work. With the help of Texas Power and Light, Moody installed an electric eye switching system that has significantly reduced electrical consumption for exterior lighting.

For further information, contact:

Harvey Pittman
City Administrator
P.O. Box 68
Moody, Texas 76557
Phone: (817) 853-2314

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City of Dallas
(pop, 844,000)

Dallas was the only survey respondent that addressed the question of exterior lighting in depth. The following is taken from the city's design manual:

Exterior Lighting

The illumination levels shown in this exterior lighting application table are expressed in footcandles on a horizontal surface. The surface is considered to be ground level. The minimum footcandles indicated should be considered to be maintained light levels rather than initial values.

EXTERIOR LIGHTING APPLICATION TABLE

APPLICATION REFERENCE	ILLUMINATION (FOOTCANDLES) MAXIMUM	MINIMUM	LUMINAIRE/REMARKS*
(1) Building face boundary with public approach (lighted strip to property line, fenced boundaries, or no more then 50 ft. total from building face).	0.14	0.17	Streetlight Type III Floodlight Type 5 or 6
(2) Building face boundary without public approach (lighted strip to property lines, fenced boundaries, or no more than 80 ft. total building face).	0.1	0.05	Streetlight Type III Floodlight Type 5 or 6
(3) Entrances			
(a) Pedestrian Entrance	4.0	2.0	Streetlight Type IV Floodlight Type 6
(b) Conveyance Entrance	2.0	1.0	Streetlight Type IV Floodlight Type 6
(c) Exterior Doors	2.0	1.0	Incandescent 60-watt bulb
(4) Pedestrian thoroughfares	0.4	0.20	1. Thoroughfares bordered by bldg. on one or

APPLICATION REFERENCE	MAXIMUM	MINIMUM	LUMINAIRE/REMARKS*
			both sides: Streetlight Type I thru IV.
(5) Vehicle Thoroughfares	0.4	0.20	2. Thoroughfares not bordered by building: Streetlight Type I or II
(6) Yards (unoccupied)	0.04	0.02	Floodlight Type 6
(7) Outdoor Storage spaces	0.2	0.10	Floodlight Type 5 or 6
(8) Interior Security Lighting	2.0	1.0	1. Dimming: Reduce all lighting to security level. 2. Switching: Turn off unnecessary luminaires to effect security level, and to reduce glare effect and minimize shadows.
(9) Inspection Routes	2.0	0.50	Supplementary or auxiliary spot or site lighting.
(10) Parking Areas			
(a) Commercial parking lots	Initial 2.0 Maintained 1.0	Minimum at any point: Initial 0.6 Maintained 0.3	Reference Sections 20-817 & 20-818, of Ordinance No. 14477.
(b) All surface off street parking lots	Initial 1.0 Maintained 0.5	Minimum at any point: Initial 0.3 Maintained 0.2	

* American Standard Practice for protective lighting - American Standards Association.

For further information, refer to:

City of Dallas
Department of Building Services
Design Standards for Maintenance and Energy Conservation, pp. 5-6

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Information Sources:

General Services Administration
Energy Conservation Guidelines for Existing Office Buildings, 2nd ed., pp. 4-18 - 4-19
Washington, D.C.: U.S. Government Printing Office, 1977

Conservation Option: Lighting Maintenance

Dirty lamps and light fixtures can lose as much as 50% of their efficiency. Frequent cleaning is one of the least expensive ways to assure efficient energy use. Luminaires should also be repainted when their reflectance falls below recommended levels.

Burned out lamps should, of course, be replaced immediately. A systematic relamping program for increased lighting efficiency based on life-cycle costing should be planned before lamps reach the end of their economic life.

Information Sources:

Dallas Power and Light Company
"Getting More for Your Money from Lighting"
Public information brochure

General Services Administration
Energy Conservation Guidelines for Existing Office Buildings, 2nd ed., p. 4-8
Washington, D.C.: U.S. Government Printing Office, 1977

Special Information Source: Illuminating Engineering Society (IES)

In early 1972, IES prepared a list of 12 recommendations to help the public better utilize energy for lighting. These recommendations apply to the design, operation, and maintenance of lighting systems for all types of buildings and summarize the conservation options presented in this section.

- Design lighting for expected activities, their duration and locations
- Design with more effective luminaires and fenestration, well-balanced and controlled for greater efficiency
- Use efficient light sources with higher lumen per watt output

- Use more efficient luminaires to produce a greater amount of light with less wattage
- Use thermal controlled luminaires to reduce the heat effect on summer cooling systems and increase interior temperature in the winter
- Use lighter finishes on ceilings, floors, walls, and furnishings, keeping with recommended reflectance ranges
- Use efficient incandescent lamps, producing higher wattage with fewer lamps
- Provide flexibility in the control of lighting through switches, dimmers, and/or photoelectric control systems
- Design fenestration to control heat-producing radiation
- Design fenestration to utilize daylighting as practicable to produce the desired illumination alone or with an electric lighting system
- Select luminaires with good cleaning capability and lamps with good lumen maintenance
- Post instructions for system operation and maintenance

For further details, refer to:

John E. Kaufman
"Optimizing the Uses of Energy for Lighting"
Lighting Design and Application, October 1973 (Reprint)

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Lighting Standards in the State of Texas Energy Conservation Plan

As required by the Energy Policy and Conservation Act of 1975, P.L. 94-163, the State has devised a program to guide the development of mandatory lighting standards for all buildings open to the public, both new and existing structures. If approved as drafted, the plan calls for the Governor's Office of Energy Resources to take lead responsibility for three tasks with the assistance of a technical advisory committee.

First, existing lighting standards and information would be collected and evaluated. If necessary, appropriate model code language would be developed. Results of these activities would be presented in regional meetings; six cities would, afterwards, test the standards. Particular attention would focus on the application of standards to existing buildings.

As a result of these tests, the Governor's Office of Energy Resources would develop state lighting standards for presentation to the 66th Legislature in 1979.

Once the standards are adopted, a second series of regional meetings would be held to explain the standards and local roles in their implementation. Training programs would also be developed and implemented for standards enforcement personnel.

For further information, refer to:

Governor's Office of Energy Resources
State of Texas Energy Conservation Plan, Vol. II, pp. 17-24
June 1977 (Draft)

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Conservation Option: Ventilation Standards

Ventilation air refers to outside air processed through the heating or cooling system in order to provide oxygen for building occupants, control odors, and maintain an interior pressure slightly higher than that outside the structure. In these roles, ventilation places a large demand on heating/cooling energy consumption because outside air is usually a different temperature than desired internally.

Building codes often contain minimum standards for ventilation air quantities. It is generally agreed, however, that these minimums are in excess of actual health and comfort needs and could be safely reduced, conserving significant energy. Many local code officials recognize this and may be willing to allow lower levels as long as required changes to the ventilation systems are not irreversible.

There has been little scientific study to back changes in ventilation standards; the General Services Administration is currently engaged in such work. Until such data are available, the National Bureau of Standards recommends the following CFM (cubic foot per minute) guidelines:

Oxygen supply	3 CFM/person
Cafeterias	10-12 CFM/person
Smoking areas	25-40 CFM/person
Odor control	5 CFM/person
Toilet exhaust	10-15 air changes per hour
Corridors	2 air changes per hour

Information Sources:

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, pp. 12-13
Washington, D.C.: Public Technology, Inc., 1975

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 8-4 - 8-5
Washington, D.C.: U.S. Government Printing Office, 1977

Conservation Option: Selective Ventilation

Considerable energy can be saved if areas in a public building are ventilated according to their function. Such an option requires that each area and its probable users be carefully analyzed for density factors, smoking/odor levels, and frequency of use before adjusting ventilation levels. For example, smoking areas, kitchens, cafeterias, and laboratories require more ventilation than do courtrooms and auditoriums with high ceilings and no smoking. Likewise, areas used for brief periods - hallways, corridors, and lobbies - could have their ventilation reduced without safety or comfort problems.

In designing new public buildings, areas with similar ventilation requirements should be grouped to facilitate selective ventilation. As always, factors of area, space volume, and intensity of odor must be considered in such design.

Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 61-62
Washington, D.C.: U.S. Government Printing Office, 1976

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 8-4 - 8-5
Washington, D.C.: U.S. Government Printing Office, 1977

Conservation Option: Other Ventilation Suggestions

A great amount of technical literature exists concerning the selection, operation and maintenance of ventilation systems. Rather than attempt to describe each energy option - and, thereby, surely overlook many good ideas - the following suggestions from the National Electrical Contractors Association and National Electrical Manufacturers Association are included as a starting point for thinking about ventilation and conservation.

- Inspect all outdoor air dampers. They should be as airtight as possible when closed. Check operation of position indicators for accuracy.
- Reduce or eliminate the need for using outdoor air for odor control by installing chemical or activated charcoal odor-absorbing devices.
- Inspect filters carefully, If necessary, create a filter replacement schedule. Utilize high-efficiency, low-cost filters.
- Reduce exhaust air quantities as practical.
- Close outdoor air dampers during the first and last hour of occupancy when the air must be heated or cooled, except when operating on economizer cycle.
- Establish a ventilation operation schedule so exhaust system operates only when it is needed most.
- Add a warm-up cycle to air handling units with outdoor air intake. Keep outdoor air dampers closed during morning building warm-up or cool-down so only air already in the building is conditioned. Cycle can be incorporated using a two-circuit time clock to control air damper and fan operation.
- Consider adding controls to shut down the ventilation system whenever the building is closed for an extended period of time, as during the evening, weekends, etc., except when the economizer cycle is in use.
- Reduce volume of toilet exhausts in buildings which have multiple toilet exhaust fans having a total fan capacity in excess of outside air requirements. This can be done by wiring a fan interlock into toilet room lights through a timed relay, so the fan is activated only when lights are on. An administrative request plus signs to the effect that lights should be turned off when the room is not in use will help ensure that lights (and thus the fan) are off when the room is not being used.
- If a large occupant load is involved, consider installing remotely adjustable outside air dampers. These permit outside air volume to be adjusted in approximate proportion to

current occupancy.

- Install baffles to prevent wind from blowing directly into an outdoor air intake.

SIGNIFICANT EXPENSE

- Consider installing economizer enthalpy controls to air handling units in offices to minimize cooling energy required by using proper amounts of outdoor and return air to permit "free cooling" by outside air when possible.
- When more than 10,000 CFM is involved, and when building configuration permits, consider installation of heat recovery devices such as a rotary heat exchanger. For some climatic conditions an "enthalpy wheel," which permits recovery of some 75% of outdoor heat load during both heating and cooling cycles, will be feasible.

Information Source:

National Electrical Contractors Association and
National Electrical Manufacturers Association
Total Energy Management: A Practical Handbook on
Energy Conservation and Management, pp. 15-16
n.p.: National Electrical Contractors Assiciation, 1976

Conservation Option: Thermostat Settings and Humidity Control

The Federal Energy Administration recommends thermostat settings of 78-80° F during summer working hours and 65-68° F in the winter (not more than 55° F during non-working hours). Estimates of savings from these actions are 5% for each degree set back in the winter to a low of 68° F, and 3% for each degree raised in the summer to a high of 78° F.

FEA also suggests the elimination of humidity control for offices in the summer and maintenance of "practicable" humidity levels in the winter for certain building populations. Public Technology, Inc., however, reports that controlled humidity levels are important year-round in maintaining employee comfort with the new thermostat settings.

Information Sources:

Federal Energy Administration
Lighting and Thermal Operations: Guidelines, p. 7-8
Washington, D.C.: U.S. Government Printing Office, 1975

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 60-62
Washington, D.C.: U.S. Government Printing Office, 1975

Conservation Option: Hours and Zoning of HVAC System Operation

When a public building is unoccupied (weekends, holidays), it seems only reasonable to reduce energy expenditures for comfort conditioning. During the summer, therefore, the interior temperature could be allowed to rise to 85° F and fall to 58° F for winter conditions (except in equipment rooms with special HVAC requirements). It is also "energy conservative" to delay operation of HVAC systems in the morning and to shut them off about 30 minutes before closing time.

Manual control in these instances may not be reliable or feasible. Automatic timing devices can be used to effectively regulate system start-up and shut-down times to achieve the greatest possible energy savings.

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City of Waxahachie
(pop. 15,000)

As one step in the City's program of efficient public building operation, Waxahachie regulates the air conditioning in its city hall by an automatic timer. This system allows proper building heating or cooling before the start of each workday, and system shut-down in the evening and over weekends without requiring any employee involvement.
For further information, contact:

Kenneth Springer
Administrative Assistant
P.O. Box 757
Waxahachie, Texas 75165
Phone: (214) 937-7330

* * * * * * * *

Large public buildings with a variety of functions should be "zoned" for efficient HVAC operation. Such zoning involves sectioning the building by major activities and then regulating the HVAC system for each zone independently. For example, cafeterias can be zoned and timed cycles developed so that the cooling system operates only when food is being served.

The General Services Administration makes two points about zoning in existing buildings. First, small or no window area exterior zones should not be under the same HVAC system with large window area exterior zones. This especially applies to systems with outside air cycles; here, the control system will provide outside air cooling to the interior or windowless exterior zone, making all other zones a reheat system. Secondly, dual duct systems or multi-zone systems with separate air handling units for each exposure and the interior will use less energy than a system serving two or more zones from the same air handling equipment.

Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, p. 62
Washington, D.C.: U.S. Government Printing Office, 1976

General Services Administration
Energy Conservation Guidelines for Existing Office Buildings, 2nd ed., pp. 6-14 - 6-15
Washington, D.C.: U.S. Government Printing Office, 1977

Conservation Option: Other HVAC Operating Suggestions

Many sources contain extensive lists of general suggestions for efficient HVAC operation; the following is an excellent example. Because each building and its HVAC system are unique, these suggestions are only guidelines and should be tailored to the specific situation.

- Reduce use of heating and cooling systems in spaces which are used infrequently or only for short periods of time.
- Heat office building to 68° F when unoccupied. This does not mean that air should be cooled if the temperature exceeds 68° F. Interior office spaces tend to experience significant heat gains due to lighting, equipment and people. Systems serving most areas use a combination of recirculated inside air and some outside air. As a result, the temperature may tend to stay at or above 68° F.
- Preheat building so that it achieves 65° F by the time occupants arrive. Complete warm-up during the first hour of occupancy. Lighting, people and use of equipment will aid in warm-up.
- Turn heat off during last hour of occupancy.

- Begin precooling operations so the building is at 80° F by the time occupants arrive. Complete cool-down during the first hour of occupancy.
- Shut off all heating in garages, docks and platform areas.
- Consider closing outside air dampers during the first and last hours of occupancy and during peak loads.
- During cooling season, evening and night hours, flush the building with cooler outdoor air.
- Allow natural humidity variations from 20% R.H. to 60% R.H. in occupied spaces.
- When appropriate, consider closing supply registers and radiators and reducing thermostat settings or turning off the electric heaters in lobbies, corridors and vestibules.
- Turn off humidifiers whenever the building is closed for extended periods of time, except when process or equipment requirements take precedence.
- Evaluate the necessity of humidification systems and curtail humidification for areas such as hallways, equipment rooms, lobbies, laundry areas, and similar spaces.
- In mild weather, lower the cooling effect by running room cooling fans at lower speeds.
- Turn off all noncritical exhaust fans.
- Turn off reheat in all areas during summer, except where equipment requirements necessitate humidity control.
- When the sun is not shining during the heating season, close interior shading devices to reduce radiation from body to cold window surfaces.
- Develop an after-hour equipment operation checklist for use by custodial and other building personnel as well as occupants who may use various spaces after normal periods of occupancy.
- Reduce internal heat generation as much as possible during the cooling season. Typical sources of heat generation include lighting, people, machines, cooking equipment, etc.
- Adjust and balance system to minimize overcooling and overheating which result from poor zoning, poor distribution, improper location of controls, or improper control.

Information Source:

National Electrical Contractors Association and
National Electrical Manufacturers Association
Total Energy Management: A Practical Handbook on Energy Conservation and Management, pp. 18-19
n.p.: National Electrical Contractors Association, 1976

Special Information Source: Total Energy Management

Heating and cooling systems exist in tremendous variety and degrees of complexity. The conservation handbook produced by the National Electrical Contractors Association and National Electrical Manufacturers Association is an excellent guide to the many technical aspects of such systems and their efficient operation. In addition to the list of suggestions included above as general operating guidelines, this handbook gives extensive information on the following HVAC topics:

- Operating practices (central plant)
- Operating practices modification - kitchen and cafeteria areas
- Maintenance modifications:
  - Refrigeration equipment (condensers, compressors, cooling tower, chillers, etc.)
  - Heating equipment (boilers, central furnaces, radiators, electrical heating, etc.)
  - Humidification and dehumidification equipment
  - Air handling equipment
  - Prime movers - motors, engines, and turbines
  - Fans and pumps
  - Hot and chilled water piping
  - Pneumatic air compressors
- Central Plant modifications (terminal reheat, dual-duct, multi-zone, induction, constant and variable air volume systems, fan coil systems, etc.)
- Distribution systems modifications (hydronic, steam, and air distribution systems)
- Control adjustment and modifications

The handbook also contains sections on lighting, infiltration, building surveys, and the establishment/implementation of an energy conservation program, to name a few. It is a highly useful, comprehensive guide for building management.

To request a copy, write:

National Electrical Contractors Association
155 E. 44th Street
New York, New York 10017

Conservation Option: Innovative Heating and Cooling Systems

There are several innovative heating and cooling systems discussed in the literature. Briefly, they include:

- Heat recovery and waste heat systems - including heat from lights, building exhaust air, hot water drains, and solid waste incinerators
- Total energy systems - where a single fuel meets all energy requirements at a site, i.e., a fuel powers an electric generator whose exhaust gases are used to heat space and/or furnish steam and domestic hot water
- Heat pumps - remove heat from outdoor winter air and distribute it for interior heating; in summer, the process is reversed to extract interior heat and reject it outdoors
- District heating - allows many buildings to be heated from a single nearby steam plant
- Solar systems - for domestic hot water and space heating/cooling

Information Sources:

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 8-11 - 8-13
Washington, D.C.: U.S. Government Printing Office, 1977

Craig B. Smith, ed.
Efficient Electricity Use: A Practical Handbook for an Energy Constrained World, p. 729
New York: Pergamon Press, Inc., 1976

Tennessee Valley Authority
A Heat Pump Program for the TVA Area
n.p.: Tennessee Valley Authority, 1975

Conservation Option: Domestic Hot and Cold Water

From 2-4% of the energy consumed in large office buildings is used to heat domestic water. To reduce this energy use, a minimum temperature of 105° F is recommended for hand washing. Self-closing faucets and flow control devices also lower demand. Some organizations have found it acceptable to cut off hot water in lavatories completely. Where higher temperatures are needed for kitchens and cafeterias (140°-180° F), a local booster heater

for that area is more efficient than heating all the building's water and piping it. All water pipes and heaters should be properly insulated so that heating or cooling energy is not lost.

Cold water for drinking should be cooled to 55° F during working hours. Controls to turn off both hot and cold water systems when the building is unoccupied may also conserve energy; one hour after the beginning of the work day is recommended as a start-up time, and 2.5 hours before the end of working hours for shut-down.

The total amount of water from off-site sources may be reduced through the following options:

- Use well water where available
- Use low volume flush systems
- Recycle waste water for water closet flushings

Information Sources:

State of Texas Building Commission
Energy Conservation Manual, Part 2: Apartment and Nonresidential Buildings, p. 63
Austin, Texas. June 1976

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., p. 9-1, and
Energy Conservation Guidelines for Existing Office Buildings, 2nd ed., pp. 7-1 - 7-2
Washington, D.C.: U.S. Government Printing Office

National Electrical Contractors Association and
National Electrical Manufacturers Association
Total Energy Management: A Practical Handbook on Energy Conservation and Management, p. 35
n.p.: National Electrical Contractors Association, 1976

Conservation Option: Elevators and Escalators

While vertical transportation in buildings is not a major consumer of energy, such equipment still provides opportunities for conservation in two areas: design and operation.

The type and amount of vertical transportation in a new public building depends on user needs, building configuration, traffic flow, and various

health/safety codes and federal laws. Generally, elevators are preferred over escalators because they use less energy. In areas with very high traffic between floors, however, escalators are more efficient.

If building renovation permits reconsideration of vertical transportation needs, it may be possible to eliminate some units or go to a zoning system whereby some units serve only lower floors and others only upper floors. When considering new equipment, remember that regenerative elevators use less energy than non-regenerative types; gearless elevators are more efficient than geared. Elevators with generator field control should also include automatic motor-generator shut down.

There are several options for more efficient operation of vertical transportation equipment.

- Shut-down equipment during nonworking hours, weekends and holidays.
- Where an escalator is infrequently used, consider supplying treadle switches to operate on demand. Safety factors are a major drawback here.
- If elevators have demand type controls, adjust them so that the fewest number of units travel the shortest distance that demand on the system allows.
- Shut down some or all escalators during periods of light traffic; they can then be used as stairs

Information Sources:

General Services Administration
Energy Conservation Design Guidelines for New Office Buildings, 2nd ed., pp. 10-1 - 10-2, and Energy Conservation Guidelines for Existing Office Buildings, 2nd ed., pp. 8-1 - 8-2
Washington, D.C.: U.S. Government Printing Office, 1977

National Electrical Contractors Association and
National Electrical Manufacturers Association
Total Energy Management: A Practical Handbook on Energy Conservation and Management, pp. 35-36
n.p.: National Electrical Contractors Association, 1976

Conservation Option: Computer Facilities

Total Energy Management reports that buildings with significant computer facilities may consume as much as 1.5 or more times the amount of energy as

structures without such equipment. The computer itself, obviously, uses energy. However, high consumption may be due more to computer support facilities and equipment and their frequent use during nonworking hours, weekends, or even around-the-clock. Such use means that other building energy-using systems (HVAC, lights, food service, vertical transportation) must also be operative.

Realizing the high productivity of computer systems and their growing use by city administrators, the following suggestions may at least ensure that energy is not wasted in computer facilities.

- Consult manufacturers to determine permissible temperature and humidity ranges. Adjust controls of computer-support HVAC equipment to provide those conditions which are acceptable and which will result in the minimum expenditure of heating/cooling/humidification/dehumidification energy.
- Reduce lighting levels to those minimums suggested by the computer equipment manufacturer.
- Develop a checklist for use by computer personnel. Such a checklist should include directions on operation of the building's lighting, HVAC, food service, elevator and other systems during periods of general building nonoccupancy. In that it is the use of other-than-computer equipment which, it is felt, contributes most to the higher energy consumption of buildings with computer installations, this step is of particular importance.
- Modify the HVAC system to permit independent conditioning of air in those areas, such as computer rooms, where special conditions are required. To provide computer-required conditions to areas where such conditions are not required can result in a significant waste of energy.
- Modify the lighting system to provide proper illumination and selective control to enable energy savings particularly during extended periods of operation when the building otherwise would be unoccupied.
- Consider installation of systems to recover heat produced by computer equipment and computer-area lighting for use elsewhere.

Information Source:

National Electrical Contractors Association and
National Electrical Manufacturers Association
Total Energy Management: A Practical Handbook on Energy Conservation and Management, p. 40
n.p.: National Electrical Contractors Association, 1976

Conservation Option: Daytime Custodial Operations

Many sources recommend scheduling custodial activities during regular working hours as a way to save energy. As in the example on computer facilities, night cleaning requires the operation of HVAC, lights, food services, elevators, etc., on almost an around-the-clock schedule, greatly increasing annual energy costs.

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City of Dallas
(pop. 844,000)

In late 1973, the Building Services Department of the City of Dallas reorganized its custodial operations to eliminate night-time cleaning. This was preceded by careful planning, including notices to all Departments by the City Manager and bulletins to all building occupants soliciting their cooperation. Custodial work hours were staggered to provide at least one hour after the normal duty day for cleaning of those few areas not accessible during duty hours. In some cases this one hour period was provided at the beginning of the day; in others, it came in the evening. Quiet, more expensive floor buffers were purchased along with small carpet sweepers and similar implements to reduce noise and other interruptions during office cleaning.

The operational change was made solely to conserve energy by eliminating both lighting and heating/air conditioning during non-working hours. However, some suprising spin-off advantages were also realized:

- Productivity increased sharply. Employees now are under constant observation by fellow employees which eliminates the tendency to "goof off".
- Supervision was also sharply reduced. It is a fact that when a large building is empty at night and custodial employees are spread throughout it on area assignments, more supervision is required.
- The moonlighter aspect was removed. Many employees used the night custodial job as a second job and were constantly tired. Daytime work is the normal American way; they now work with more spirit.

- With increased productivity, the total custodial force was reduced.
- Moral/espirit improved. For the first time, custodial employees can identify with City employment. They are now personally acquainted with the people who occupy and work daily in the area they clean.

Very soon, employees, executives, and others became conditioned to having the custodial employee enter private offices to remove trash, dust, empty ash trays, and perform other quiet duties.

For further information, contact:

H. E. Drumwright, Director
Building Services Department
1500 W. Mockingbird
Dallas, Texas 75201
Phone: (214) 630-1111

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If it is not possible to reschedule cleaning during working hours, at least attempt to perform all cleaning in one area at a time so that minimal lighting is required by the entire staff. Lights should be turned off in an area that has been cleaned and the staff proceed to other areas that have been unlighted.

Information Source:

Minnesota Energy Agency
Energy Management for Commercial Buildings, p.4
St. Paul, Minnesota: n.p., n.d.

Special Information Source: City of Dallas Custodial Manual

The Dallas Custodial Manual is an excellent reference for custodial employees at all levels. This guide takes a comprehensive look at cleaning including descriptions of routine procedures, floor care, carpets, restrooms, exterior, and periodic cleaning. In addition, it covers use and care of professional equipment and a section on skills needed in supervisory positions. While specific instructions may vary among cities depending on plant size, equipment, etc., this manual is one way to train and impress upon employees the importance of proper custodial maintenance and the efficient

use of supplies and equipment.

For further information, refer to:

City of Dallas
Building Services Department
Custodial Manual

Copies may be obtained from the Director of Purchasing, City Hall, Dallas, Texas, 75201. Ask for Publication No. 76-1015.

Conservation Option: Building Energy Audits

In order to develop an effective building energy management plan, it is necessary to first have basic information about municipal structures. This information gathering job is commonly called a building energy audit and allows city administrators to accomplish the following tasks:

- Develop an energy data base on all municipal buildings/facilities
- Monitor energy consumption by individual building and by groupings of similar buildings to determine efficiency of operation
- Establish an energy conservation goal and then keep a progress record of conservation techniques implemented to reach that goal
- Forecast energy costs for future planning and budgeting based on past rates of consumption

The initial energy audit should strive to identify all forms of energy used in a building and any obvious areas of waste. More detailed audits - performed by professionals in engineering and mechanical systems - can be used to measure specifically when, where, and how each energy form is used and to correlate this information with such building factors as hours of use, occupancy patterns, climate, etc. The results of such analysis will give management an idea of each building's energy cycle and, again, point out opportunities for conservation. Periodic audits held thereafter can monitor conservation progress and provide further up-to-date control information.

Building energy audits in use across the nation today vary greatly in form and complexity. In some areas, a simple "walk through" inspection by an employee with a checklist can be combined with accounting department energy bills to provide a relevant basis for conservation planning.

Example: Mecklenburg County, North Carolina

In 1975, three employees from the Mecklenburg County Building Inspection Department (one each from areas of air conditioners, electrical use, and general buildings) performed a comprehensive energy audit of county buildings. When combined with energy use/cost date from accounting, the record of historical use and cost in 1974 shown as Figure 3.5 was developed.

Such information might also be transferred to individual "profile" cards for each public building. The cards would then provide quick data in event of energy curtailments or for planning conservation projects.

For other examples of energy use reports applicable to buildings, see the manual section on conservation management information tools.

Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, p, 61
Washington, D.C.: U.S. Government Printing Office, 1976

Mecklenburg County, North Carolina
Energy Conservation Program Interim Report, pp. 10-13
Revised February 1976

National Electrical Contractors Association and
National Electrical Manufacturers Association
Total Energy Management: A Practical Handbook on Energy Conservation and Management, pp. 8-11
n.p.: National Electrical Contractors Association, 1976

Nassau County, New York
Department of General Services
"Nassau County Energy Program," p. 4 (Mimeographed)

Conservation Option: Building Conservation Inspections

Especially in cities with many widely scattered public buildings, it may be difficult to keep track of how effectively conservation recommendations are actually being carried out in daily operations. In response to this situation, the City of Baltimore formed teams to inspect all city-occupied buildings to determine compliance with various city conservation directives. Each building manager or head of an agency housed in the building is given a copy of the inspection and evaluation report so that corrective action can

Figure 3.5

Mecklenburg County

SUMMARY: 1974 ENERGY AND COST ON EACH BUILDING

Building	Square Footage	% Glass Area	Type Heating	Type Cooling	Total Energy Consumption for 1974				Total Annual Cost for 1974 in $				
					Gas in CCF	Elect in KWH	Oil in Gal	Coal in #	Gas	Elect.	Oil	Coal	Cost Totals All Energy

3.42

be taken.

Information Source:

City of Baltimore
Assorted letters, brochures, and reports on the city's conservation program, 1977

Conservation Option: Computerized Building Energy Management

Perhaps the most sophisticated building energy management techniques available today are those computer systems developed by many nationally-known private businesses. Such systems can handle a variety of tasks including HVAC, lighting, equipment, and temperature control. The availability of virtually instantaneous consumption data and the preciseness of automated controls hold tremendous potential for conservation as well as promoting longer equipment life and reducing operation and maintenance personnel requirements.

Computerized energy management systems are expensive. Savings in consumption and payback period will vary with the system installed. Each building therefore should be carefully analyzed to determine the best system for its particular needs.

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City of Dallas
(pop. 844,000)

In mid-1973, City of Dallas selected the Honeywell Delta 2000 system as the means of centrally operating mechanical HVAC equipment in its new City Hall, completed this year. This is an analogidigital system which transmits data from numerous sensors to appropriately-located data gathering panels and thence on to the central console monitored by the continuous on-duty operator.

BOSS is a system of service offered by Honeywell through contract arrangement. Honeywell uses the Delta 2000 to provide this operating/monitoring service to building owners by time-sharing the equipment and thereby keeping individual costs down. To gain experience with the system and be prepared to operate its own Delta 2000 in 1977, Dallas contracted with Honeywell in 1974

to provide BOSS service to sixteen buildings: remotely-located branch libraries, health clinics and several other facilities. When the new City Hall and the City's own Delta 2000 came on the line, the leased telephone lines to these sixteen buildings were switched over to that system and the Honeywell BOSS contract terminated. Progressively, the control will then be expanded to a maximum number of city buildings and, somewhere in the process, the Honeywell mini-computer with software will be added. Thus, most City buildings will be "operated" by one employee at one central location.

Under the computerized system, alarm conditions/emergencies are transmitted by the operator to a specific City-designated maintenance organization which responds, corrects the condition on-site, and ties back to the operator eventually to complete the cycle. Nights, weekends, and off-duty situations are similarly handled by designated City employees.

Advantages to the City have included:

a. Significantly reduced/eliminated number of building operating personnel

b. Improved responsiveness; aware of trouble long before the occupant cries "too hot" or "too cold"

c. Significant reduction in utility consumption by constant monitoring of building conditions, readjusting for changes in ambient temperatures and humidity, shut-down and start-up times

d. Opportunities for load-shedding

For further information, contact:

H. E. Drumwright, Director
Building Services Department
1500 W. Mockingbird
Dallas, Texas 75201
Phone: (214) 630-1111

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Information Source:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, p. 65
Washington, D.C.: U.S. Government Printing Office, 1976

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Commercial Buildings
in the
State of Texas Energy Conservation Plan

Under provisions of the Energy Policy and Conservation Act, P.L. 94-163, states were required to develop plans for five areas and allowed to develop any optional programs they wished. Texas responded in its draft plan with optional programs for new and existing commercial buildings.

Both program measures are directed toward informing building designers, builders, owners, and managers about energy conservation opportunities. Both include the development and presentation of workshops for all interested parties and training courses for building professionals. Professional training for new commercial buildings would focus on two areas: designing an efficient building shell and building equipment. For existing commercial buildings, the program would emphasize energy auditing and the evaluation of conservation opportunities.

For further information, refer to:

Governor's Office of Energy Resources
State of Texas Energy Conservation Plan, Vol.II, p. 71-90
June 1977 (Draft)

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IV Public Vehicle Fleets

IV: Public Vehicle Fleets

Conservation Option: Vehicle Fleet Inventory

In developing a comprehensive energy conservation plan for public vehicles, it is useful to have at hand a detailed inventory of the existing fleet. This inventory should include such information as number and type of vehicles owned, maximum passenger load, usual duties, gasoline consumption, and any special equipment on individual units or available for use by all vehicles (radios, trailers, etc.). Using this data, city administrators can better match vehicles with their most efficient uses, plan for future purchases, and monitor on-going vehicle conservation plans.

Information Source:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 33-34
Washington, D.C.: U.S. Government Printing Office, 1976

Conservation Option: Smaller Vehicles

Selection of new vehicles for the municipal fleet should involve careful comparison of the relative fuel economy values of contending vehicle makes and models for a given application (police cars, passenger cars, etc.). With the ever increasing cost of fuel, additions to a municipal fleet should lean toward smaller vehicles. Such vehicles, with lower gross weight, horsepower, and axle ratios, will get better gas mileage while providing the same services as larger vehicles. Advantages of the smaller vehicles include:

- Lower initial cost
- Greater fuel economy
- Ease of service and maintenance
- Suitability to urban use
- Availability of options similar to larger vehicles (electronic ignitions, front wheel drive)

Compact vehicles should be considered for use in the health and building inspection departments, city motor pool, water and electric meter reading, etc. If greater carrying capability is occasionally needed, small trailers can be added to meet this demand while minimizing vehicle weight

during normal operation.

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Texas Cities and Smaller Vehicles

Almost every Texas city contacted during this study reported the purchase of smaller vehicles since the 1973 oil embargo. Many now use intermediate-sized cars for police and certain administrative officials; some have gone to compact or subcompact vehicles for other uses. Small pickups seem especially popular.

This downsizing has not always been without its problems. At least one city reported strong employee opposition initially that was overcome only with time and educational efforts. Another common complaint stemmed from the fact that EPA miles-per-gallon ratings are generally overstated, leading to some disappointingly low fuel savings.

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Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 33-34
Washington, D.C.: U.S. Government Printing Office, 1976

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, pp. 43-44
Washington, D.C.: Public Technology, Inc., 1975

Conservation Option: Lighter Vehicles

One way to increase fuel economy is through the purchase of smaller, lighter vehicles. Another option for existing vehicles is to lighten their normal load of equipment.

Example: Southwestern Bell Telephone

Currently, Southwestern Bell Telephone Company is trying to reduce the weight of each telephone company truck by 100 pounds. All unnecessary tools and equipment are being removed since the lighter the vehicle , the less energy it takes to operate. If the company achieves this goal, they predict

a 1.5 percent savings in gasoline usage.

Information Sources:

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, pp. 43-44
Washington, D.C.: Public Technology, Inc. 1975

Southwestern Bell Telephone
Assorted conservation information. May, 1977

Conservation Option: Diesel Engines

One Department of Transportation report notes the following fuel economy improvements when diesel engines are substituted for gasoline engines in trucks:

- 20-40% improvement for light-duty trucks, vans, and pickups
- 51.9% improvement for medium-duty trucks
- 48% improvement for short hauls

With the generally lower prices of diesel fuel, it seems ridiculous not to recommend an immediate conversion for all municipal trucks. There are other considerations, however, that must be examined and weighed before taking such a step. First, conversion requires complete replacement of existing gasoline engines; diesel engines are larger and heavier. This process is expensive and generally recommended for an entire fleet on a gradual basis in connection with the purchase of new vehicles. Additional pumps, tanks, etc., must also be purchased for the storage and delivery of diesel fuel. Diesel engines may be harder to start in cold weather and are noisier than gasoline engines. Finally, diesel vehicles are more expensive initially; purchases should be based on life-cycle costing analysis to see if such vehicles are really more cost effective in each particular jurisdiction.

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City of Wichita Falls
(pop. 102,000)

Wichita Falls has an equipment replacement policy specifying diesel

engines. Any of the heavy equipment which can be replaced with diesel-powered equipment is done so when replacement time comes around. As an example, the city-owned transit system, involving approximately ten buses, is being gradually replaced with diesel vehicles. Two advantages of this policy are longer engine life and a significant price difference in diesel fuel.

For further information, contact:

Gerald Fox
City Manager
P.O. Box 1431
Wichita Falls, Texas 76307
Phone: (817) 322-5611

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Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 35-36
Washington, D.C.: U.S. Government Printing Office, 1976

U.S. Department of Transportation
A Study of Technological Improvements to Optimize Truck Configurations for Fuel Economy, pp. 5-15
Washington, D.C.: U.S. Government Printing Office, 1975

Conservation Option: Fuel Flow (MPG) Meters

The Motor Vehicle Information and Cost Savings Act, as amended by the Energy Policy and Conservation Act (PL 94-163), states:

> Sec. 512, (a) Within 180 days after the date of enactment, the Secretary shall prepare and submit to the Congress and the President a comprehensive report setting forth findings and containing conclusions and recommendations with respect to (1) a requirement that each new automobile be equipped with a fuel flow instrument reading directly in miles per gallon, and (2) the most feasible means of equipping used automobiles with such instruments. Such report shall include an examination of the effectiveness of such instruments in promoting voluntary reductions in fuel consumption, the cost of such instruments, means of encouraging autobile purchasers to voluntarily purchase automobiles equipped with such instruments, and

any other factor bearing on the cost and effectiveness of such instruments and their use.

The report from the Secretary of Transportation responding to this requirement was submitted to Congress and the President in July of 1976. These conclusions were contained in that report:

- At the present time, it has not been demonstrated that the use of available mpg meters will improve fuel economy for typical drivers.
- The most effective means of equipping used cars with mpg meters is to convince the public that the meters will save them money.
- The least expensive commercially available mpg meter would cost about $130 installed. Fuel economy increases of 12% would be needed to cover the installed cost of the mpg meter after the third year.
- An original equipment price of $75 is estimated when mpg meters are factory-installed in new cars. A 5% fuel economy increase resulting from the use of the mpg meter would pay for the meter through fuel savings in about three years for a large car or about six years for a small car.
- Means for encouraging consumers to purchase automobiles equipped with mpg meters include advertising, driver education, tax benefits, and subsidies to manufacturers of meters. These measures are only likely to be effective when it is shown that mpg meters are safe, economical, effective, and convenient to use.

Based on these findings, the Secretary of Transportation recommended that Congress not mandate a requirement for mpg meters on new cars and that no action be taken at this time to promote the use of such meters on used cars.

Information Source:

U.S. Department of Transportation
Survey of Driver Aid Devices for Improved Fuel Economy
Washington, D.C.: U.S. Government Printing Office, 1976

Conservation Option: Other Driver Aids for Conserving Gasoline

There are several driver aids commercially available at present, both as original and add-on equipment. The manifold vacuum gauge is the most

widely used monitor of automobile fuel economy. A large variety of these gauges is available; they are simple in design, reliable in operation, relatively inexpensive, and easy to install as add-ons. All major U.S. auto manufacturers offer vacuum gauges as optional equipment on new cars. Meter readings, flashing lights, or audio signals show the driver his fuel economy.

Speed control and cruise control are available either as original or add-on equipment. These devices automatically maintain a steady speed, and thus improve fuel economy. Fuel-flow meters, which measure the rate at which fuel is being consumed, and fuel totalizers, which measure the amount of fuel consumed for a selected period of time, are also available as add-on equipment. Devices for measuring exhaust temperature may be helpful in measuring engine efficiency and fuel economy on diesel trucks. They have recently become available as add-on equipment for automobiles.

Information Source:

U.S. Department of Transportation
Survey of Driver Aid Devices for Improved Fuel Economy
Washington, D.C.: U.S. Government Printing Office, 1976

Conservation Option: Radial Tires

Radial tires have been promoted for their safety and increased fuel economy due to reduced rolling resistance. In addition, most studies indicate that the life expectancy of radials on trucks is approximately the same as for regular bias ply tires. Even though radial tires are initially more expensive, fuel savings and life expectancy may make them feasible for city vehicle use depending on the local cost of fuel.

In 1975, a National Bureau of Standards Law Enforcement Laboratory report warned against the use of radial tires for police patrol and other high-speed vehicles. Their study showed that as radial tires become overheated at high speeds, the rubber tread lets go of the steel belts and the tire blows out. Two deaths and twenty non-fatal accidents were documented as being caused by such blowouts.

Information Sources:

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, p. 44
Washington, D.C.: Public Technology, Inc., 1975

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, p. 36
Washington, D.C.: U.S. Government Printing Office, 1976

Conservation Option: Electric Powered Vehicles

One method of curbing fuel demands is to use electric powered vehicles. Presently, such vehicles are available but have definite operational limitations: the maximum range is 50 miles, and the speed attained does not conform to highway driving but is suitable for urban use.

Electric vehicles are cheaper to run than conventional vehicles. Electrics are normally charged on low cost off-peak electricity produced at evening and nighttime hours. The electric motors have only two metal-to-metal moving parts so wear is negligible, breakdowns few, and maintenance bills extremely low. Electric vehicles also last longer - usually twice as long as conventional vehicles.

These vehicles can be effectively used to carry goods and passengers. The U.S. Post Office is presently using electric delivery jeeps since they are ideal for multi-stop operations. College campuses offer another good area for electric vehicles, especially for grounds keeping and delivery service.

The initial cost of electric vehicles is somewhat higher than conventional vehicles. However, this cost is offset by their double life expectancy, reduced maintenance, and fuel economy. Electric vehicles should be considered for city park patrol, meter reading, and other operations where the range is less than 50 miles.

Information Source:

Lead Industries
"Is Your Fleet Ready for Electric Vehicles?"
Reprint from Commercial Car Journal
May 1974

Conservation Option: Propane Powered Vehicles

Boyce Megason, Chief of Police, The University of Texas at Arlington, implemented a program in which campus police vehicles were retrofitted with propane gas fuel systems. The University initially used small gasoline scooters, but maintenance costs proved astronomical. Tuneups on full-size vehicles were also very frequent due to short range cruising and parking lot patrol.

The retrofit device costs approximately $400 apiece initially. At the University, payback can be realized within about six months due to almost negligible tuneup costs. The propane apparatus can also be reused on a new vehicle for a $50-$75 installation charge. Although mileage remains about the same, propane fuel is purchased for about 20 cents per gallon less than regular gasoline. The power of the vehicle is unchanged if not improved because propane carries a 125 octane rating. State and federal safety requirements are also met by this system.

The simple propane device occupies very little space under the hood with a 100 gallon tank in the trunk, practically out of sight. Two small pickups, also University police vehicles, carry the tanks in the truck bed snug against the cab and taking up approximately 18 by 31 inches.

UTA has a two-year price and service contract with an Arlington propane firm. The propane retrofit device is purchased from, installed and serviced by this same company. The propane supply is kept on campus.

Megason feels that initial cost probably prohibits most local governments from implementing propane fuel vehicles. He stressed that reduced maintenance costs and "down time", however, make it a worthwhile investment.

Since UTA adopted the propane fuel system, New Mexico State University has followed their example.

Information Source:

Boyce Megason
Chief of Police
The University of Texas at Arlington
Davis Hall, Room 9
Arlington, Texas 76019
Phone: (817) 273-3381

Conservation Option: Vehicle Maintenance

Routine maintenance offers one of the best opportunities for conserving fuel. The exact time interval (or vehicle mileage) which transpires before vehicle fuel economy is seriously affected would be expected to vary somewhat according to driving conditions, quality of gasoline used, etc. However, the auto industry has for years recommended that the engine be tuned up (set timing, replace points, plugs, condenser, clean carburetor) at 10,000 to 12,000 mile intervals to retain good performance and economy. With the use of unleaded fuels by newer automobiles and ignition systems, the recommended tune-up interval has in most cases been extended to 20,000 miles or greater.

Vehicle maintenance is most importantly a matter of recording the maintenance and enforcing the maintenance schedule. Smaller local governments might accomplish this on a departmental basis with each person who is assigned a city vehicle held responsible for reporting at the scheduled odometer reading. The fleet manager should also keep correct maintenance schedules and notify departments when their vehicles are due. Larger fleets often have the advantage of a computer. Usually, data is automatically recorded whenever the vehicle reports for gasoline, including odometer reading, number of gallons, oil, battery and tire inflation.

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City of Lancaster
(pop. 13,700)

Lancaster has implemented a preventive maintenance program for solid waste equipment. Designed to overcome problems of excessive maintenance costs, the project includes programmed preventive maintenance and rapid repairs. As a result, downtime has been reduced and net savings for the first six months are $7,900 over the same period last year.
For further information, contact:

John Marshall
City Manager
P.O. Box 548
Lancaster, Texas 75146
Phone: (214) 227-2111

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Briefly, a regular maintenance check should include the following:

- Tire pressure
- Spark plugs
- Lubricating oil viscosity
- Tune-up points and timing
- Air pollution equipment
- Carburetor
- Choke and throttle
- Air and oil filters
- Wheel alignment
- Belts
- Radiator
- Exhaust system

Information Source:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 34-35
Washington, D.C.: U.S. Government Printing Office, 1976

Conservation Option: Used Lubrication Oil

In connection with large vehicle fleet maintenance, a great deal of lubrication oil is used. In the past, many cities have paid to have used oil hauled away. With current oil prices, however, some cities may find it profitable to collect this oil and sell it to private contractors. Waste oil is also being experimented with for use in the manufacture of asphalt products.

Information Source:

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, p. 43
Washington, D.C.: Public Technology, Inc., 1975

Conservation Option: Driver Education

The single most important element in determining fuel economy of a particular vehicle is the driving technique of the individual behind the wheel. Each vehicle operator should be properly trained to be conscious

of fuel economy. The Federal Energy Administration indicates that a careful driver should be able to get 30% better mileage than the average driver. It is recommended that local governments conduct classes to educate vehicle operators in fuel saving measures including the following:

- Avoid extended idling - when not in traffic, turn off engine if you are standing still for more than 60 seconds
- Operate vehicle at speeds under 55 at all times (except emergency and police vehicles)
- Use air-conditioner sparingly
- Maintain an even speed. Driving at a constant speed can improve fuel economy by seven to nine percent over what the fuel economy would be if the speed is varied as little as five MPH.
- Avoid rapid ("jackrabbit") starts and stops
- Do not overfill gas tank
- Return vehicle promptly for scheduled maintenance
- Report any malfunction or increase in gas consumption immediately
- Keep tires inflated at correct pressure
- Remove excess weight

Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, p. 33
Washington, D.C.: U.S. Government Printing Office, 1976

Federal Energy Administration
Don't Be Fuelish (Pamphlet.)

General Services Administration
Tips for Conserving Gasoline (Pamphlet.)

National Science Foundation
Public Fleet Management
n.p.: National Science Foundation, 1975

Special Information Source: LEAA Summary of Fuel Economy Factors

The Law Enforcement Assistance Agency (LEAA) Emergency Energy Committee compiled the following list of factors influencing fuel economy. Such a summary would be an informative memo for city employees who utilize public vehicles.

Item	Impact, mpg
Configuration	
Added weight	Standard: -0.1 mpg for each additional 100 lb Intermediate: -0.2 mpg for each additional 100 lb Subcompact: -0.4 mpg for each additional 100 lb
Engine size	0-2 mpg for 10% increase in displacement (urban driving)
Dual exhausts	+1 mpg in highway driving
Fan clutch (or Flex-Fan)	+1 mpg in highway driving
Air conditioning	-1 to -2 (urban driving), while in use depending on temperatures
Heavy duty alternator	-0.9 mpg (urban driving)
Power steering	-0.7 mpg (urban driving)
Radial tires	+0.5 mpg
Automatic transmission	-1.6 mpg (urban driving)
Rear axle ratio	+0.6 mpg for 10% decrease in highway driving
Operation	
Fast starts	-2 to -4 mpg in urban driving
Varying cruise speed 5 mph	-1 mpg in highway driving
12% idle time (parked)	-1 to -2 mpg in urban driving
Maintenance	
5^{0} ignition retard	-1 mpg
One spark plug misfiring 50%	-1 mpg
Tires underinflated	-1 mpg
0.25 in. toe-in misalignment	-0.3 mpg.

Conservation Option: Passenger Car Assignment

Most cities have some policy - formal or informal - concerning the use of municipal passenger cars. Since the energy "crisis", many communities have tried to cut down the number, size, and overnight use of these vehicles by various means.

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City of Port Arthur
(pop. 57,371)

In late 1973, Port Arthur responded to the shortage of fuel supplies by developing a broad scale conservation program to reduce city energy use by 15 percent. One part of the written program involved city vehicle assignment and use.

> Criteria for allocation of City vehicles should be: (1) City related business and activities; (2) City should benefit from the allocation. Restrictions on use of city equipment should be on a city-wide basis and equitable to all employees. Suggest consideration of the following:
>
> 1. Management, supervisory personnel required to attend schools, meetings, hold conferences, make surveys and inspections at other than regular working hours or days - transportation should be furnished to conduct city-related activities.
>
> 2. Employees subject to call at off hours and weekends - transportation should be furnished.
>
> 3. Employees who are assigned regular after hours or weekend duty should be furnished transportation.
>
> 4. Under emergency situations - hurricanes, rainstorms, when authorized by the Department head in writing for the duration of the emergency.
>
> 5. An equitable approach should be considered for those employees with car allowances for personal vehicles.

For further information, contact:

George Dibrell
City Manager
P.O. Box 1089
Port Arthur, Texas 77640
Phone: (713) 983-3321

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Cincinnati, Ohio, has the most detailed written policy uncovered in this study. In that city, persons are assigned cars based on the following data:

Basic Vehicle Specifications

Basic Vehicle Size	Classification Body Style	Specifications Wheelbase	Automatic Transmission	Power Steering	Power Brakes
Sub-compact	2 door sedan	94" to 100"	Yes	No	No
Compact	4 door sedan	106" to 113"	Yes	Yes	No
Intermediate	4 door sedan	114" to 119"	Yes	Yes	Yes
Station Wagon	4 door 8 passenger	118" to 122"	Yes	Yes	Yes

Basic assignments for specific positions include:

	Approved Car Size
City Manager	Intermediate
Deputy City Manager	Compact
Police Beat Cars (does not include beat supervisors, i.e., Lieutenants and Sergeants)	Intermediate
Police Beat Supervisors, Lieutenants and Sergeants	Compact
All other uniformed and non-uniformed personnel unless other size is approved by the Automotive Equipment Committee based on form 199 submitted.	Sub-compact

A Motorized Equipment Committee composed of five city officials rules on written requests for larger cars based on the following criteria:

	Committee will consider
When more than 2 people are consistently in the car every day -	
3 or 4 people	Compact
5 or 6 people	Intermediate
7 or 8 people	Station Wagon*
For out-of-town travel at least once each week. Division should use one car for all trips if possible. To qualify trips must be at least 100 miles round trip.	Compact or Intermediate
For carrying heavy, awkward, or large items too much for a sub-compact, and where a van or pickup can be proven to be impractical.	Compact, or Intermediate, or Station Wagon

* Suggests consideration of compact van wagon.

Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, pp. 33-34
Washington, D.C.: Government Printing Office, 1976

Cincinnati, Ohio
City Purchasing Department
"City Passenger Car Size Policy" (Mimeographed)

Conservation Option: Fuel Dispensing Systems

There are several types of fuel dispensing systems available for city use. Key operated, computerized credit card, and simple manual systems will be briefly examined herein.

Key operated systems provide 24 hour unattended service. Fuel dispensers are activated by a key issued only to an authorized vehicle operator for a particular vehicle. Each gallon dispensed is recorded on the totalizer being used by the keyholder, thus providing a fuel inventory of the fuel used. Master keys are included so that owners may read individually registered totals on the pump's totalizer. Key operated units are available that can be mounted on existing pumps.

The computerized credit card system is a more sophisticated approach to fuel dispensing that provides for maximum accountability of fuel and inventory. In this system, each authorized person is issued a credit card which, when inserted into the card reader, activates the fuel dispenser. In a municipal credit card system, two cards may be used to activate the dispenser: one for the driver, and the other for the vehicle used. Such a system records the card number, time, date, type of fuel dispensed, etc. An odometer input can also be included to provide data for vehicle maintenance; if odometer readings are not entered, fuel will not be dispensed. Several controls are available for computerized credit card systems which prevent unauthorized use:

- Automatic limits for each vehicle so that vehicle cannot draw more fuel than it will hold
- Automatic shut-offs which prevent the pump from dispensing gasoline for too long a period of time
- Alarm systems which sound off when invalid cards are inserted in the card reader

Benefits of the computerized credit card system include:

- Complete management control of fuel dispensing
- Continuous on-line management information
- Elimination of fuel pump operators
- All city pumps can be tied to a single, centrally located mini-computer
- Capability of direct input into a vehicle management program to provide automatic keypunching of fuel transactions in the

necessary format for the main computer program. This would eliminate errors in fuel transactions and preclude the "loss" of transaction slips.

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City of Rosebud
(pop. 1,597)

Even a small city can benefit from accurate, up-to-date fuel consumption records kept through a simple manual system. Rosebud has two city fuel pumps. A legal pad is kept at each pump for the drivers of city vehicles to record the following information at each fill up:

- Vehicle mileage meter reading
- Date of fill up
- Vehicle identification (backhoe, patrol car, etc.)
- Number of gallons for fill up
- Name of vehicle operator

With this information, the city manager can keep up with mileage per vehicle and plan a schedule of preventive maintenance to maintain operating efficiency. For further information, contact:

Dan Roark
City Manager
P.O. Box 657
Rosebud, Texas 76570
Phone: (817) 583:7926

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Information Source:

Public Technology, Inc.
Automated Fuel Dispensing for State and Local Governments
Washington, D.C.: Public Technology, Inc., 1977

Conservation Option: Vehicle Routing

A planned system of routing for city vehicles making daily or weekly runs can be useful in promoting fuel conservation and avoiding unnecessary "empty hauls" wherever possible. Street sweepers, mowing equipment, library bookmobiles, and solid waste collection trucks are examples of city vehicles whose routing should be examined for possible fuel savings.

Solid waste collection has been frequently analyzed in connection with routing improvements. During the 1973 oil embargo, many cities cut collection schedules to once a week, required curbside rather than backyard pickup, and even converted to single side of street pickup in order to reduce vehicle fuel use. In addition to these measures, the Federal Energy Administration recommends routing analysis based on the following steps:

- Eliminate collection on main arteries during traffic rush hours
- Eliminate as many left turns as possible
- Reduce repeated distances or dead travel
- Reduce overlapping routes in cities served by more than one private collection contractor

Several organizations have developed routing system plans that can be adapted to municipal vehicles. The U.S. Environmental Protection Agency guidelines follow:

> Objective: To minimize the non-collection distance and delay times for each collection vehicle.
>
> The Office of Solid Waste Management Programs of the U.S. Environmental Protection Agency has developed a simple non-computerized "heuristic" or common sense approach based on the following rules of thumb:
>
> 1. Routes should not be fragmented or overlapping; they should be compact, continuous, and contiguous.
> 2. The collection route should be started as close to the garage or motor pool as possible, accounting for heavily traveled streets.
> 3. Heavily traveled streets should not be collected during rush hour periods
> 4. One way streets should be collected starting at the "upper" end, working down.
>
> The heuristic rules are guides which help in determining the vehicle path or route.
>
> Once the starting point has been selected, the last two heuristic rules (the street segment selection procedures) become the basis for routing, keeping in mind the other heuristic rules and the two points below:
>
> 1. At each decision point the "router" looks ahead and behind several street segments and asks several questions:
>
>   - Do any of the heuristic rules apply here? Are they being violated?

- Are there any street segments that are being left behind that will require a long "dead" distance to go back and pick up?
- Are there already any long dead distances that might be reduced through slight modifications?
- Are there any peculiar or unique characteristics of the area which should be considered?
- Are there any patterns that can be utilized in the routing?

2. Once the initial route layout has been determined the route should be retraced and alternate routings or modifications attempted wherever apparently long "dead" distances exist.

In summary, the street segment selection procedures, and other heuristic rules, facilitate the routing process, but must be tempered with a common sense examination at the decision points to determine the final route for implementation. Emphasis should be placed on utilizing routing patterns where appropriate.

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City of Caldwell
(pop. 2,574)

Caldwell has a rather unique, informal program that helps reduce fuel costs for hauling dirt from street or utility repairs/construction. The city maintains a list of citizens who have requested fill dirt or top soil. As water/sewer leaks are repaired or city streets constructed or repaired, the dirt that is removed from these sites is hauled to the nearest requested area inside city limits. If there are no current citizen-requests, certain standing locations are used. Citizen response to this program for the past 3-4 years has been good; the city has realized savings in fuel and manpower costs.

Two major problems exist, however; care must be taken not to damage private property when a load is dumped or to compete with local dirt hauling businesses. The latter has not surfaced as a major issue because the city service is small-scale and not available on any dependable schedule.
For further information, contact:

Johnny Smith
City Manager
214 W. Buck Street
Caldwell, Texas 77836
Phone: (713) 567-3271

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City of Jasper
(pop. 7,000)

Jasper avoids any problem of competition with private contractors by hauling excess dirt to city-owned property. In this way, a swampy area next to the city's future senior citizens center/museum (an old Victorian house to be restored) has been filled for paving as a parking lot.

For further information, contact:

Wayne DuBose
City Manager
272 East Lamar
Jasper, Texas 75951
Phone: (713) 384-4651

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Information Sources:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, p. 37
Washington, D.C.: U.S. Government Printing Office, 1976

U.S. Environmental Protection Agency
Solid Waste Collection Systems: A Five Stage Improvement Process
Washington, D.C.: U.S. Government Printing Office, 1973

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, pp. 40-41
Washington, D.C.: Public Technology, Inc., 1975

Conservation Option: Solid Waste Transfer Stations

Large cities with distant landfills may find that the use of a transfer station and specialized equipment will result in significant fuel savings. EPA has estimated that savings of 10 percent can be achieved by having regular collection vehicles empty their loads into larger, compactor carriers at conveniently located transfer stations throughout the collection area served. The larger vehicles would then make the trip to the landfill, saving fuel by reducing the number of daily trips there and the number of "empty" loads back to city collection points.

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City of Richardson
(pop. 70,150)

Richardson constructed its own transfer station, equipped with multi-load heavy duty compactors. Since Plano uses the same landfill (located outside Richardson), that city contracted with Richardson for use of this transfer station. Under the agreement, Plano collects its own garbage and hauls it to the station where it is loaded onto Richardson's compactors and taken to the landfill. Costs for this service are based on tonnage generated by Plano.

For further information, contact:

Ted Willis
Assistant City Manager
P.O. Box 309
Richardson, Texas 75080
Phone: (214) 235-8831

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Information Source:

Federal Energy Administration
A Guide to Reducing Energy Use Budget Costs, p. 37
Washington, D.C.: U.S. Government Printing Office, 1976

Conservation Option: Larger Solid Waste Collection Vehicles

As an alternative to transfer stations, cities may wish to purchase larger solid waste collection trucks. The increased capacity of such trucks permits savings through a reduction in the overall number of routes and in the frequency of trips to the landfill.

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City of Ft. Worth
(pop. 409,868)

The energy crisis of 1973 and the desire for further economy in the solid waste management program led the City of Fort Worth to experiment with numerous types of collection vehicles utilizing larger vehicles and smaller crews. Fort Worth purchased 23 new trucks which utilize two-man crews per vehicle and retain a 900 household-per-day collection average by eliminating

one landfill trip per day per vehicle.

For further information, contact:

Donald LaBelle
Assistant Director of Public Works
1000 Throckmorton
Fort Worth, Texas 76102
Phone: (817) 335-7211

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Conservation Option: Quick Response Fire Vehicles

It is a waste of fuel and manpower to send large pieces of fire equipment to small fires. Wherever small fires are identified by the caller, therefore, it is more efficient to send smaller "quick response" vehicles, e.g., 100-gallon mini-pumpers. Equipping such vehicles with radios insures that larger pumpers can be called if the need arises.

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City of Amarillo
(pop. 150,000)

Amarillo is purchasing smaller "quick response" vehicles for use in such emergencies as auto and grass fires. This equipment cuts response time - making possible lessened damage to citizen property - and reduces the need for city investment in large, expensive fire vehicles.

For further information, contact:

Jerry McGuire
Assistant City Manager
P.O. Box 1971
Amarillo, Texas 79186
Phone: (806) 372-4211

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Special Information Source: Philadelphia's Comprehensive Automotive Information System

The following explanation of Philadelphia's unique comprehensive vehicle fleet management system is presented exactly as received from that city.

Scope

This Automotive Information System covers all of the City of Philadelphia automotive operations including all vehicles, all fuel pumps and all automotive facilities, including parts and supplies, as well as non-City agencies using the City fuel pumps.

Purpose

The automotive operation of the City of Philadelphia is a large complex operation running around the clock, seven days a week. It includes such diverse functions as airport emergency vehicles, police, fire, highway maintenance, collection of trash, and running a water and sewage system to astro-turf vacuum cleaners. The number of vehicles and pieces of motorized equipment is in excess of 5,000. The original purchase value of the vehicles and equipment is in excess of $25 million. The annual expenditures for new vehicles, equipment, repair parts, maintenance labor, fuel and tires are close to $40 million, and an annual consumption of fuel in excess of 12 million gallons. There is in excess of two million transactions a year in the Automotive area.

To manage an operation of this size and complexity, management must be concerned with the following:

a. Determination as to the number and types of vehicles needed to carry out the various functions of the City.

b. Development of vehicle and equipment specifications.

c. Determination of when to replace vehicles.

d. Conducting negotiations and maintaining relations with manufacturers, including resolving warranty problems.

e. Assigning and dispatching vehicles.

f. Providing for and controlling maintenance.

g. Monitoring and controlling both vehicle and shop operations.

h. Distribution of the costs to the proper functions.

The efficient management of such resources requires information. There is no substitute. The information must be timely, accurate, concise and to the point. It must highlight the problem areas. Management by exception requires information and is imperative for this size operation. The purpose of the Automotive Information System is to provide this information.

Outline

The system is built around two major computer disk files; the Master Vehicle File and the Master Inventory File. These two disk files are on-line with the computer and are accessable

by computer terminals. The major portion of the up-dating of the system is batch up-dated with approximately 2 million optical, scannable documents per year which by passes key punching. The terminals in the various major automotive facilities can inquire into the file, but only the centralized terminal can up-date or modify the file through the terminal. Various reports are printed out for different purposes with the report format geared to the particular purpose. These reports vary from detail control reports to summary analytical type reports. As a rule, no detail is printed unless it is necessary and useful to the particular function.

FEATURES

A SINGLE FILE

All information concerning City-owned vehicle and non-City owned vehicle fuel permits is contained in one computer disk file, thereby ensuring accuracy and economically by concentrating all file maintenance up-dating and control effort on a single file.

A SINGLE VEHICLE TRANSFER FACILITY AND DOCUMENTS

A single vehicle inspection and exchange station was established. This facility permits an effective control over the size of the fleet by means of having all new vehicles delivered, inspected and prepared for operation, transfers between departments and condemnation handled at the one location under a single responsibility and physical control. The trade-in vehicle must be turned in in order to obtain the new vehicle unless an increase in the fleet has been properly approved by the appropriate authority by means of change of authorization form. The condemnation and sale of the old vehicles are handled at the same location. A single document follows the vehicle through all steps which insures that the computer actually matches the fleet.

PLASTIC I.D. CARDS

All vehicles and motorized equipment have been issued plastic I. D. cards similar in appearance to credit cards which are used to identify the vehicle in connection with all fuel, parts or service transactions. There are two types of I.D. cards: yellow for City-owned vehicles, and blue for non-City owned vehicles such as the Board of Education, Philadelphia Housing Agency, etc.

AUTHORIZED FLEET LEVEL

An Authorized Fleet Level broken down by department, element and types of vehicles has been established as the result of a review of operational requirements of the departments. This Authorized Fleet Level can not be changed except by the Managing Director's Office by means of a special form which covers the reassignment of rehabilitated vehicles. The vehicle reference provides a continuous and an automatic comparison or the actual and Authorized Fleet Level.

COMPUTER TERMINAL ACCESS

The information concerning any one vehicle is available on a moment's notice by means of Computer Terminals. These are located at the central office and at the Major Automotive Shops. In addition to vehicle number, serial number, using agency, make, model, model year, responsible maintenance shop and other descriptive information, information such as culminative maintenance costs, PM History Fuel Consumption, odometer readings are available.

MAINTENANCE COST HISTORY

The History of Maintenance Costs of each vehicle is maintained with breakdowns by types of cost (labor material, apply overhead and outside repairs), various major systems within the vehicle and by service years, as well as life to date costs. This data is available both through the termina! and by means of special analytical printouts.

PREVENTIVE MAINTENANCE AND STATE INSPECTION SCHEDULING

A history of the date and odometer reading or hours of operation "A", last "B", last "C" PMs and the date of the last State inspection is maintained and is available through the terminals at the main office and at the major shops.

This history along with the current odometer reading or hours reading and the current date are used as the vehicle is scheduled for preventive maintenance and State inspection using both actual usage and elapsed time as criterions.

VEHICLE DOWN TIME REPORTING

As each vehicle enters or leaves a maintenance shop, a document is imprinted with the vehicle I.D. card and is processed through the scanner to record that fact and up-date the computer. The fact that a particular vehicle is in a shop, which shop, the date it went into the shop, and why is available on the terminal. There is also a daily vehicle down report for top management and operational management. In addition, the vehicle down time history life to date and by service years is maintained on each vehicle.

PARTS AND SUPPLIES INVENTORY

Data on inventory activity, balance on hand, consumption history, and dollar value as the flow of costs from purchases to installation in a vehicle is maintained on each item in the inventory. This information again is available on the terminal as well as special inventory printouts. There is a complete audit trail and an internal control system. One transaction or document updates all files (inventory, vehicle cost history, cost distribution by shop and the department using the vehicle) with complete integration of all records.

COST ACCOUNTING AND SHOP MANAGEMENT

Under the Automotive Information System, there is an integration of cost accounting breakdown of all shop costs including depreciation, paid leave, fringe, shop supplies, etc. with shop management and control. It provides an analysis of both productive costs with units of work completed including rework and repeat work. It provides an analysis of costs with comparison with quanitity and quality of work performed. This analysis is provided on five levels of supervision or organization from City-wide basis down to the individual foreman or work center.

USING AGENCY COST DISTRIBUTION AND/OR BILLING

The total costs of operating a vehicle including maintenance costs, depreciation, fuel and tires for each vehicle or fuel permit with totals indicated by sub element, department and City-wide are accumulated and printed out. By this means, the total Automotive costs for any activity, function or department can be determined.

In addition, the following statistics are available for each sub element, department or City-wide number of vehicles which were repaired, number of repair orders written for the vehicles which

were repaired, the number of shifts down lost because of repairs, the number of gallons of regular, diesel and hi-test fuel consumed.

FUEL CONTROL SYSTEM

Under the Automotive Information System, fuel (gasoline and diesel) consumption by 7,000 vehicles is monitored. The fuel inventory activity, 220 pumps, and balance on hand data is maintained on each fuel pump. The gallons of fuel consumption and costs are available by four organization levels from City-wide to a particular function. The information is recorded at the pump site by means of a vehicle I.D. card which is similar to a commercial gas credit card and a data recorder which is similar to the credit card sale recorder at gas stations. Approximately 6,000 of these fuel transactions are run through a bar code scanner each day without any key-punching.

VEHICLE REPLACEMENT FORECASTING

When to replace vehicles has always been a problem, but coupled with this, a governmental budgeting and procurement cycle, the problem can become very complex. Because of this, the City of Philadelphia could be operating a vehicle 18 months to 48 months after a decision is made to replace and replacement is ready.

If the decision to replace is made on historical data and present physical condition, the vehicle is being operated 18 months to 48 months depending on the type of vehicle beyond its uneconomical point. To avoid this problem, the replacement must be forecast so that the replacement is ready for services as the older vehicle is just reaching the uneconomical point. By maintaining costs and operating data by service year on each vehicle and grouping the vehicles by like vehicles doing the like work, it is possible, with the use of statistical analysis, to forecast the replacement point in advance.

VEHICLE ANALYSIS

A provision has been made to analyze the vehicles individually and in similar grouping of make, model and use in order to evaluate the vehicles as well as they are holding up and how one set of specification or make compare to another set of specification or another make. This analysis picks out vehicles which are significantly different from its group as well as the comparison of group to group.

This type of analysis helps to pick out vehicle abuse, improper specification for the vehicle use or a basic problem with the manufacturer.

SHOP MANPOWER SCHEDULING

With different shops maintaining different types and different mixes of vehicles, it can be very difficult to determine how much manpower each shop should have. In addition, as a change in the mix of vehicles occurs or additional vehicles are added, what effect does it have on the manpower requirement. The system is maintaining the number of direct labor hours spent on each vehicle along with the number of 4 week periods it has been in service. With this information, it is possible to obtain the average annual number of direct labor hours spent on each vehicle and by grouping like vehicles together, it is possible to obtain a composite City-wide average for each type of vehicle.

By multiplying the number of each type of vehicle assigned to each shop by the City-wide composite average, and totaling the totals for each type, it will give the number of total direct labor hours for a year for a shop. By coupling this information with the established relationship of indirect labor, support personnel and paid leave, it is possible to come up with a estimate of the annual manpower needs in each shop.

The same information can be used to estimate the effect of change in the mix of equipment in the shop or the adding of a mix of new vehicles.

For further information, contact:

Anthony Martin
Deputy Managing Director
1620 Municipal Services Building
Philadelphia, Pennsylvania 19107

V Transportation Systems

V: Transportation Systems

Roadway and Traffic Control Efficiency

Conservation Option: Traffic Flow Management

There are several commonly used techniques for smoother traffic flow that help increase the mobility of all vehicles on the road. Greater ease of movement, in turn, means that all vehicles - both privately and publicly owned - used less fuel.

General techniques for improved traffic flow include:

- Better channelization for traffic
- One-way streets to reduce congestion
- Effective parking regulations
- Exclusive turning lanes
- Better traffic signal systems
- Progressively timed ("green flow") traffic signals
- Computerized traffic flow control

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City of Victoria
(pop. 50,000)

As a part of the Federal Highway Administration's TOPICS project (Traffic Operations Program for Increased Capacity and Safety), Victoria instituted a program of traffic signal timing designed to let vehicles travel through the city with a minimum of stops. Traffic signals at fifty city intersections were set for operation by a single master control to promote "green flow" movement through these areas.

The program overall has been successful in improving traffic flow. One problem with the system, however, is the tendency of vehicles making left turns to hold up the flow and disrupt subsequent timing.

For further information, contact:

John Lee
City Manager
P.O. Box 1758
Victoria, Texas 77901
Phone: (512) 573-2401

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Information Source:

U.S. Department of Transportation
Improving Urban Mobility, p. 1
Washington, D.C.: U.S. Government Printing Office, 1975

Conservation Option: Improve Bus Movement on Freeways

The U.S. Department of Transportation suggests three ways to improve bus travel efficiency on freeways.

First, exclusive busways can be designated. Such a setup reduces passenger travel time significantly by prohibiting other vehicles from using the less congested lane (although in some cases, carpools/vanpools may also be permitted to use the lane). An 11-mile busway on the San Bernadino Freeway carried over 10,000 bus passengers daily in 1975, an increase of 437 percent over pre-busway averages. Another large busway feeding into Washington, D.C., from Northern Virginia has two reversible median lanes; in 1975, over 300 buses daily used this system, carrying 16,000 round-trip passengers. Both examples have reduced travel time by 10 to 15 minutes. Other positive traits of busways are that they can be constructed "incrementally" and, if future traffic load warrants, they can be converted to light or rapid rail facilities.

Secondly, contra-flow freeway bus lanes can allow express bus travel in underutilized freeway lanes. At peak travel times, one side of the freeway is often congested while traffic on the other is relatively light. Reserving one underutilized lane next to the median for buses and permitting them to drive against the usual traffic flow there can improve the entire road's efficiency. Pylons separate buses from oncoming traffic to prevent accidents. Contra-flow busways between the New Jersey Turnpike and Lincoln Tunnel and near San Francisco are very successful examples of this concept.

Finally, reserved entrance and exit privileges at freeways, toll plazas, and bridges can improve bus travel efficiency in situations where traffic volume is too low to justify an exclusive busway. For example, Seattle's "Blue Streak" project allows buses the exclusive use of an existing one-way freeway ramp which feeds into a special circulation loop in the central city. Directions of travel are reversed in the evening to accommodate the heavier outward traffic flow. At the Oakland Bay Bridge toll plaza, three lanes are

reserved for buses and carpools. Buses do not stop to pay toll; the transit system is billed directly later.

Information Source:

U.S. Department of Transportation
Improving Urban Mobility, pp. 2-5
Washington, D.C.: U.S. Government Printing Office, 1975

Conservation Option: Improve Bus Movement on City Streets

The U.S. Department of Transportation describes three alternative means of facilitating bus movement on city streets where problems of congestion and air pollution are especially intense.

Several cities have designated curbside lanes or lanes within an unused median as exclusive bus lanes. New York, San Francisco, and Baltimore have extensive networks of such lanes. One problem arises in that these lanes are generally not bordered with any pavement barriers so that illegal parking in the lane greatly hinders movement. A solution is to establish contra-flow bus lanes on otherwise one-way streets, separated from other traffic by some type of barrier. Contra-flow bus lanes are found in San Antonio, Harrisburg, and Honolulu.

A second option is the development of bus streets - entire streets reserved for exclusive bus use in high density urban areas. More space for passenger loading/unloading is created by building two extra curbs in the center of the street. Various routes are then assigned specific boarding locations marked clearly with signs. Chicago and Minnesota have bus streets in limited areas.

Finally, there are a variety of traffic control techniques that give public transit vehicles priority at intersections. These include: lengthening or relocating transit stops to reduce pedestrian-vehicle conflict; permitting transit vehicles to "override" traffic signals for extra seconds of movement though an intersection; and permitting buses to use restricted left-turn lanes at peak times.

Information Source:

U.S. Department of Transportation
Improving Urban Mobility, pp. 8-10
Washington, D.C.: U.S. Government Printing Office, 1975

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City of Dallas
(pop. 844,000)

In 1970, the U.S. Department of Transportation initiated the Urban Corridor Demonstration Project (UCDP) wherein available highway traffic engineering and transit operations technology were tested for their efficiency in relieving traffic congestion in radial corridors serving major urban areas. Dallas was chosen as one of eight demonstration cities, implementing individual projects in the following areas along a 12-mile stretch of the North Central Expressway:

- Roadway and Traffic Control
  - Preferential ramps
  - Bus priority signals
  - General traffic engineering
- Improved Transit Services and Facilities
  - Express bus service
  - Dial-a-ride
  - Park-ride facilities
  - Public information and marketing

In addition to these UCDP programs, Dallas was already involved in a comprehensive program of freeway corridor optimization that included traffic sensing, ramp metering, closed-circuit television monitoring, and a driver advisory system using changeable-message signs.

For details of these projects, contact:

Jim Heggie
Traffic Operations
(Administration)

or

Bob Whitson
Traffic Operations
(Engineering)

2721 Municipal St.
Dallas, Texas 75201
Phone: (214) 421-5521

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Public Transit Services and Facilities

Conservation Option: General Improvements

An improvement in service that encourages people to ride public transit rather than drive their own cars contributes to improved vehicle movement and conserves energy. Primary elements of improved transit service are reduced travel time, more frequent service, and more reliable service. These elements can be achieved by the following general suggestions from the U.S. Department of Transportation:

- Improved scheduling - increases the frequency of bus services; offer express service
- Improved routing - routes that serve commuters within 4-5 miles of the central business district; in-town routing that corresponds closely to passenger needs
- Route information - presented clearly and frequently both on-board and outside the vehicles
- Improved fare collection - tokens, stored-value or time-value tickets, punch cards, extended fare-contracts with large employers
- Improved vehicles - more comfortable, quieter vehicles; greater capacity vehicles such as double-decker and articulated buses
- Alternative transit services for sepcial needs - downtown shopper buses, Sunday routes at reduced rates to city entertainment and recreation areas; buses adapted to carry bicycles and accommodate baby strollers, wheel chairs, shopping carts, etc.

Information Source:

U.S. Department of Transportation
Improving Urban Mobility, pp. 11-18
Washington, D.C.: U.S. Government Printing Office, 1975

Conservation Option: Transfer Facilities

Transfer sites exist wherever passengers leave one mode of transportation for another. For a transit system to attract riders, it is important to make these transfers as quickly and conveniently as possible.

In outlying or low density areas, fringe parking lots allow easy trans-

fer from private autos to public bus or rail transit. Such "park-and-ride" lots may be existing lots at shopping center, sports stadiums, or churches - wherever the facility's own highest parking demand generally exists after work or on weekends. In return for use of their lots, businessmen may receive free advertising on the buses or in bus service literature; many commuters find it convenient to shop before continuing the trip home.

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City of Dallas
(pop. 844,000)

One park-and-ride facility in Dallas is located at a 1,000 space drive-in theater in the northern part of the city. In 1975, the facility was used by about 800 customers per day with an average of 500 vehicles.
For further information, contact:

Jim Heggie
Traffic Operations
(Administration)

or

Bob Whitson
Traffic Operations
(Engineering)

2721 Municipal St.
Dallas, Texas 75201
Phone: (214) 421-5521

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Transfer points within the city should also be planned, to the extent possible, to serve a variety of transportation modes. Better coordination of bus, rail, taxi, and subway services will allow passengers to continue their trips with minimal interruption, enhancing the attraction of public transit.

Information Source:

U.S. Department of Transportation
Improving Urban Mobility, pp. 13-15
Washington, D.C.: U.S. Government Printing Office, 1975

Conservation Option: Demand Responsive Service (Dial-a-Ride)

Demand responsive service allows people to telephone for door-to-door transportation to a location within a specified service area. The major difference between "dial-a-ride" or "telebus" service and private taxis

is that the former collects a greater number of people and carries them at the same time to their destinations.

Characteristic of demand responsive service is flexible scheduling and routing, relatively small transit vehicles (12-20 passengers), and door-to-door service. The U.S. Department of Transportation notes the following roles of such service:

- Feeder service to regularly scheduled bus or rail transit. Passengers are gathered from many origins, often on a pre-scheduled, regular basis and delivered to a common location such as a rapid transit terminal or a bus transfer facility. This process can be reversed to provide service from the terminal to scattered destinations.
- Transportation in low-density suburban areas ill-suited for traditional bus operations. Generally, service is offered between any origin-destination combination possible in the service area.
- Specialized service for the elderly, the handicapped, or those in fragile health who cannot walk long distances to regular transit stops, cannot wait outdoors for indefinite periods or in inclement weather, and cannot afford to hire a taxi.
- Alternative to the private automobile, particularly to commuting and local trip needs such as shopping, clinic visits, social meetings, and chauffeuring children.

There are problems with demand response services. A 1977 analysis of a "dial-a-ride" program in three small Michigan cities noted that while such projects are commonly assumed to be inherently energy efficient,

> In typical installations, however, Dial-A-Ride does not save fuel. To the contrary, the introduction of Dial-A-Ride into test communities in Michigan has resulted in a net increase in fuel used for transportation. The principal reasons for this are inducement of trips which would (could) not have been made without the new service, a low average number of passengers per vehicle (load factor), circuity of routing, poor vehicle fuel economy, and diversion of passengers from more energy-efficient modes.

The report goes on to conclude that the program does offer an important service to persons with no other affordable means of transportation. It suggests that demand responsive services everywhere be examined with an eye to increasing fuel economy through more efficient vehicles and operating policies.

Information Source:

William R. Hershey
"Dial-A-Ride's Impact on Transportation Energy Consumption in Small Cities"
January 1977. (Mimeographed)

Special Information Source: Rural Transportation

In 1976, the U.S. Department of Transportation published a state-of-the-art overview of rural passenger transportation services across the nation. The report begins with a definition of the rural transportation disadvantaged - those poor and elderly in rural areas who are unable to own or operate private automobiles. Three general modes of transportation were found to be available to rural families in varying degrees:

- Private automobiles - the dominant mode but, again, not available to the poor and many elderly
- Public transit - rail service is oriented to traffic between major cities with many cutbacks in service to rural areas in-between; intercity buses simply do not reach most rural families or their scheduled runs are not frequent enough to provide critical human services and job transportation needs; rural bus services are still relatively rare, serving usually only special needs or special groups of the population.
- Other modes - air and water transportation are available only in special situations; low population density generally makes conventional taxi service uneconomical or far too expensive for many persons.

The report describes in detail the results of its nationwide survey of ways to increase rural mobility. The following brief outline is presented as a summary of their findings:

- Modification of existing transportation systems:
  - Ridesharing - hitchhiking, carpooling or soliciting rides from friends and neighbors (both as a favor and for a fee)
  - Mechanisms for providing vehicles - reimbursing individuals for providing transportation to others with their private automobiles or providing automobiles to carpool drivers who then are allowed to use them for their own purposes after work; assisting the poor in getting conventional bank loans for automobiles; guaranteeing such loans where necessary; extending intracity bus systems to surrounding rural areas; subsidized taxi service for the elderly; using

school buses during school hours for other transport services.

- Rural transportation projects: 75 selected projects were surveyed; six provided service to the general public, the rest served only the elderly and poor
  - Demand responsive services - "dial-a-ride" (see previous conservation option)
  - Fixed route, fixed schedule - the traditional bus service operating in rural areas; it may deviate under special circumstances to provide door-to-door service, which is called combination routing.

The report, after discussing three specific projects in detail, concludes with a lengthly examination of general factors and problems in planning and implementing rural transportation systems. The report as a whole is highly recommended to any organization - whether a city, county, or non-profit service agency - considering this type of service.

For further information, refer to:

U.S. Department of Transportation
Rural Passenger Transportation: State-of-the-Art Overview, October 1976
Washington, D.C.: U.S. Government Printing Office, 1976

This report can be ordered from:

Mr. R. V. Giangrande
Chief, Office of Technology Sharing
U.S. Department of Transportation
Transportation Systems Center
Kendall Square, Code 151
Cambridge, MA 02142
Phone: (617) 494-2486

Ridesharing Programs

Conservation Option: Ridesharing Programs

By now, "carpool" is a familiar term to nearly everyone. It explains the concept of more than one person per car sharing a ride to and from work or other destinations. With the 1973 energy "crisis", great emphasis was placed on all citizens to voluntarily "pool it" wherever possible in their daily travels.

The concept of carpooling has been expanded to include a broader range of transport sharing arrangements. Increased emphasis on public mass transit and vanpool services initiated by many large private businesses has made the term "ridesharing" a more preferred usage today. The basic focus remains the same, however - share a ride to reduce the number of vehicles on the road and, thereby, reduce the tremendous amount of fuel consumed daily by passenger transportation.

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Photochemical Oxidant Controls for Texas

On July 21, 1977, the Environmental Protection Agency announced regulations and compliance dates for reducing photochemical oxidants that now pollute the air in metropolitan areas of Texas.

Petrochemical oxidants are defined as secondary pollutants formed by the action of sunlight on the oxides of nitrogen and hydrocarbons in the air. The petrochemical oxidant standard recognized by EPA is 0.88 parts per million hourly average, not to be exceeded more than once per year. This means that, except for one hour each year, the amount of petrochemical oxidant (averaged over a one-hour period) should not exceed 100 million parts air.

The extent to which the new controls will improve air quality may vary from region to region, depending on weather conditions as well as emissions. The EPA is continuously monitoring for new data needed for evaluations and projections.

On November 11, 1976, EPA proposed amendments to the previous petrochemical oxidane (hydrocarbon) control strategy for Texas, and measures now

being promulgated are modified from these proposals based on public comments. The action or final rule effective July 21, 1977, was published as follows in the Federal Register for that date:

Title 40-Protection of Environment

CHAPTER 1 - ENVIRONMENTAL PROTECTION AGENCY

Subchapter C - Air Programs (FRL 765-4)

PART 52 - APPROVAL AND PROMULGATION OF IMPLEMENTATION PLANS

Texas

AGENCY: Environmental Protection Agency

ACTION: Final rule.

SUMMARY: This rule amends the photochemical oxidant (hydrocarbon) control strategy promulgated for Texas on November 6, 1973. The National Ambient Air Quality Standard (NAAQS) for photochemical oxidants continues to be exceeded in parts of Texas. The measures being promulgated by the Environmental Protection Agency (EPA) at this time are not sufficient to demonstrate attainment of the NAAQS for oxidants; therefore, this plan must be considered as an interim plan only and further measures will be considered as more data become available. Reduction in the peak levels and frequency of violations of the standard can be accomplished through application of reasonable control strategies, and are the goal of this interim plan.

EFFECTIVE DATE: July 21, 1977

FOR FURTHER INFORMATION CONTACT:

Oscar Cabra, Jr., Chief
Technical Support Section
Air and Hazardous Materials Division
Environmental Protection Agency - Region VI
Dallas, Texas 75270
(214 - 749-3837)

Several years ago, four Texas cities - Ft. Worth, Dallas, San Antonio, and Houston - were funded for the establishment of voluntary metropolitan carpool programs in keeping with EPA's hydrocarbon control strategy for Texas. The reasoning behind this effort was that assisting people in the establishment of carpools would reduce the number of vehicles operated, thereby reduc-

ing pollution from hydrocarbon emissions. As a side benefit, fuel would also be conserved.

The amendments to the EPA photochemical oxidant control program for Texas announced July 21, 1977, now mandate employers of 250 or more persons and educational facilities with 1,000 or more commuters to initiate "carpool incentive programs" by the following deadlines:

Facility Type	Size	Compliance Date
Employment facility:	1,000 or more employees	Oct. 1, 1978
	500 to 999 employees	Nov. 1, 1978
	250 to 499 employees	Dec. 1, 1978
Educational facility:	5,000 or more employees	Oct. 1, 1978
	1,000 to 4,999 employees	Nov. 1, 1978

Texas cities employing 250 or more persons are included under these guidelines.

Officially known as the "Employer Mass Transit and Carpool Incentive Program" (Section 52.2297), this new program is designed to eliminate as many autos from the highways as possible and, as a result, promote better air quality and energy conservation through a reduction in vehicle miles traveled. This multifaceted program sets down various steps that employers must take in order to comply with new regulations. They include:

- Posting of routes and rates of mass transit services available to the facilities
- Publicize any street parking restrictions in effect near their operations
- Negotiate with local mass transit operations to improve service to their facilities
- Participate with other employers in their area in establishing carpool programs
- Post schedules of park and ride services in the area
- Negotiate with local authorities for a street commuter plan
- Make a feasibility study of the possibility of "van pooling" employees

The new guidelines also require employers to prepare status reports on their carpooling initiatives. While compliance is mandatory for covered employers, participation by employees in the programs to be established is still volun-

tary.

The following table summarizes all measures and compliance dates, including the carpool incentive programs, established by the EPA:

SUMMARY OF PHOTOCHEMICAL OXIDANT CONTROLS FOR TEXAS
Promulgated by the Environmental Protection Agency

REGULATION	AREA TO WHICH REGULATION APPLIES	COMPLIANCE DATE
Bus and Carpool Feasibility Study	Harris, Dallas, Tarrant and Bexar Counties	Sept. 1, 1979
City Carpool Matching	Houston, Dallas, Fort Worth and San Antonio	Dec. 1, 1977
Employer Carpool Incentive Program	Collin, Dallas, Denton, Ellis, Hood, Johnson, Kaufman, Parker, Rockwall, Tarrant, Wise, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Waller, Bexar, Comal and Guadalupe Counties	Oct. 1, 1978
Monitoring Mode Trends	Collin, Dallas, Denton, Ellis, Hood, Johnson, Kaufman, Parker, Rockwall, Tarrant, Wise, Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Matagorda, Montgomery, Waller, Bexar, Comal and Guadalupe Counties	March 31, 1979
*Extension of TACB Regulation V to Tarrant and Hardin Counties	Tarrant and Hardin Counties	Feb. 29, 1980
**Vapor Recovery Stage I	Harris, Galveston, Brazoria, Fort Bend, Waller, Montgomery, Liberty, Chambers, Matagorda, Bexar, Comal and Guadalupe Counties	Aug. 31, 1976
**Vapor Recovery Stage I	Dallas, Tarrant, Denton, Wise, Collin, Parker, Rockwall, Kaufman, Hood, Johnson, and Ellis Counties	Sept. 30, 1978
Crude Oil Storage	Brazoria, Dallas, El Paso, Galveston, Hardin, Harris, Jefferson, Matagorda, Montgomery, Nueces, Orange, San Patricio and Tarrant Counties	Feb. 29, 1980

* Texas Air Control Board Regulation V controls hydrocarbon emissions from storage tanks, loading and unloading facilities, water separators and waste gas disposal streams.

** Applies to the filling of gasoline storage tanks and refilling of tank trucks.

For further information, contact:

Betty Williamson, Director
Office of Public Affairs
Environmental Protection Agency
Region VI
First International Building
201 Elm Street
Dallas, Texas 75270
Phone: (214) 749-1151

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Most Texas cities are currently served by a metropolitan or regional ridesharing agency established several years ago, either the local council of governments, the local transit authority, or the State Department of Transportation. These agencies are very helpful to cities starting ridesharing programs, usually providing a computer program, standardized maps, and matching forms. Smaller cities, especially those who do not have computer facilities available, can greatly benefit by working with these lead agencies.

Any one who is beginning a ridesharing program should try to take advantage of the services offered by these agencies. If you do not know which agency is responsible for ridesharing in your area, contact the Federal Highway Administration (FHWA) representative in Austin who will supply you with the name of the lead agency.

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City of Fort Worth
(pop. 409,868)

The implementation of the Metropolitan Fort Worth Carpool program began April 1, 1974, after a federal grant of $80,000 was awarded to the City pursuant to Section 3, the Emergency Highway Energy Conservation Act of 1974, on a matching basis. Similar grants were awarded to the cities of Dallas, San Antonio and Houston.

Metropolitan Fort Worth Carpool was designed to encourage the use of carpools in the area, increasing the average automobile occupancy during peak traffic or rush hours. The formation of carpools would serve as a means of conserving energy, reducing traffic congestion and abating air pollution.

The implementation phase of the carpool program consisted of two basic approaches: contacting all employers having 50 or more employees, and provid-

ing a telephone call-in service directed at the general public. Both approaches are now underway.

The first approach focuses on employer/employee contact. Initially, a letter from the Mayor of Fort Worth is mailed to executives of major firms in Tarrant County asking them to participate in the program. This is followed by a telephone call from the Transportation Coordinator to the recipient of the letter asking for an appointment to discuss the program in more detail. During this interview, arrangements are made for the employer to distribute carpool forms and information to his employees and a system is established for the collection and return of these forms to the carpool staff.

The second approach to participation in this carpool program involves a telephone call-in service available to all citizens working in Tarrant County who may desire to use the program. Those who call are sent a carpool mail-out form (Figure 5.1) and a grid map. After the form is returned to the city, it is screened for completeness and sent for keypunching to data processing. After a computer run is made, a match list of available carpoolers is sent to the participant.

Figure 5.1

TRANSPORTATION SURVEY AND
REQUEST FOR RIDESHARE MATCHING

(PLEASE PRINT)

NAME _____ DATE _____

HOME ADDRESS _____ (Number and Street) _____ (City) _____ (Zip Code)

HOME PHONE _____ OTHER PHONE _____ (At work, etc.) Ext. _____

DESTINATION ADDRESS _____ (Number and Street) _____ (City) _____ (Zip Code)

NAME OF COMPANY, SCHOOL, ETC. _____ DEPT. _____

TIME YOU MUST ARRIVE AT YOUR DESTINATION _____ AM _____ PM

TIME YOU WANT TO LEAVE FOR HOME _____ AM _____ PM

HOW DO YOU GET TO WORK NOW? 1. ☐ Car-drive alone. 2. ☐ Bus 3. ☐ Taxi 4. ☐ Motorcycle

5. ☐ Carpool—indicate number of persons including driver _____. 6. ☐ Bicycle. 7. ☐ Walk.

DO YOU WANT TO PARTICIPATE IN OPERATION RIDESHARE'S CARPOOL MATCHING PROGRAM:

1. ☐ Yes. Add me. to the list. 2. ☐ I'm already enrolled. 3. ☐ I'm enrolled but need a new list. 4. ☐ No. I cannot share a ride.

IN A CARPOOL WOULD YOU PERFER TO 1. ☐ Drive only 2. ☐ Ride only 3. ☐ Share driving

Signature _____ (optional)

For further information, contact:

Reeta McMorrow, Carpool Coordinator
OPERATION RIDESHARE
City of Fort Worth
1000 Throckmorton
Fort Worth, Texas 76102
Phone: (817) 335-7211

* * * * * * * *

Information Sources:

U.S. Environmental Protection Agency
"Protection of Environment"
Federal Register 42, no. 140, 21 July 1977
37376 - 37386

U.S. Environmental Protection Agency,
Region VI
"Environmental News"
July 21, 1977 (Mimeographed)

Conservation Option: Vanpools for City Employees

Vanpooling is a ridesharing concept pioneered by the 3M Company in St. Paul, Minnesota. Vanpooling is an extension of the carpooling concept; however, where carpools can accomodate up to five passengers, vans accomodate from eight to fifteen. Carpools often alternate drivers and cars, but a vanpool has a designated driver responsible for keeping records, charging passengers, and maintaining the van. Vanpooling seems to have the greatest promise for establishments having a large number of employees.

Vanpools offer two major benefits. It is estimated that each van will take eight cars off the road and produce an annual reduction of around 81,000 vehicle miles traveled. Based on EPA maximum allowable emission standards for 1975-76 models, each van has the potential for an annual reduction of 2.7 tons of pollution from the atmosphere; or, using the average of eight cars removed per van, this would be 1.78 tons per year. Taking into consideration the number of older models in use, coupled with the decreased efficiency of anti-pollution devices from the ageing effect, the current reduction is probably in the area of 4 tons per year.

Information Sources:

3M Company
The 3M Commute-A-Van Program Status Report II
St. Paul, Minnesota: 3M Company, 1977

Continental Oil Company
"Vanpooling, A Commuting Alternative that Works"
February 1977 (Mimeographed)

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Ridesharing in the State of Texas Energy Conservation Plan

Responding to a requirement for a program addressing public mass transit under the Energy Policy and Conservation Act, P.L. 94-163, the Governor's Office of Energy Resources has proposed a program measure for developing three series of twenty-four workshops each on the topics of vanpools and carpools.

Co-hosted by the state's twenty-four Metropolitan Planning Organizations, the first series of workshops would involve municipal, civic, community, public interest, and state groups representing all local interests. At these workshops, the state energy conservation plan would be reviewed, a local program coordinator selected, and major employers, industries, manufacturers, and facilities in each area identified. The second series of workshops would examine various issues connected with ridesharing programs, including methods, costs/benefits, problems, and incentives. The third series would provide information for local coordinators.

In addition to the workshops, the Governor's Office of Energy Resources would host two seminars at the end of the second and third workshop series in 1979 and 1980. These seminars will enable program coordinators to compare the relative effectiveness of local programs and to share the experiences of each year's efforts.

For further information, refer to:

Governor's Office of Energy Resources
State of Texas Energy Conservation Plan,
Vol II, pp. 25-
June 1977 (Draft)

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Bikeways and Walkways

Conservation Option: Bikeways

The bicycle is becoming an increasingly popular mode of transportation. As this popularity grows, cycling enthusiasts are demanding more safe, enjoyable riding facilities designed especially for their needs.

There are several alternatives for developing a bikeway system. Paths can be marked by signs or pavement markings on existing streets with a low volume of traffic. In high traffic areas, safety considerations may require physical barriers or even a separate paved bikeway for riding. Recreation areas (parks, lakes, etc.) should include scenic recreational bikeways suitable for even the youngest rider and equipped with such amenities as water fountains, picnic tables, and rest stops on steep slopes.

There are many factors to be considered in developing and implementing a city bikeway plan. Briefly, these include system goals, design characteristics, legal considerations, funding sources, maintenance, safety programs, and community involvement.

Information Sources:

U.S. Department of Transportation
Improving Urban Mobility, pp. 21-22
Washington, D.C.: U.S. Government Printing Office, 1975

Institute of Urban Studies
University of Texas at Arlington
Bikeways For Flower Mound
Arlington, Texas: University of Texas at Arlington, 1976

Conservation Option: Pedestrian Walkways

The goal of developing pedestrian walkways is to provide an attractive alternative to the automobile for short trips. In addition, such projects can help reduce traffic congestion, revive retail sales, and lower noise and air pollution levels in congested city centers.

Pedestrian zones can take several forms: auto-restricted areas, skyways, malls, and areas reserved for pedestrians and public transit services.

Information Source:

U.S. Department of Transportation
Improving Urban Mobility, pp. 22-23
Washington, D.C.: U.S. Government Printing Office, 1975

VI Municipal Utilities

VI: Municipal Utilities

Conservation Option: Criticism of Declining Block Rate Structures

Declining block rates is the most commonly used rate structure in the nation and in Texas. Under this schedule, customers are charged according to the amount of electricity used; the unit price decreases as the number of units (KWH) consumed increases.

Great criticism surrounds this rate system for encouraging higher overall consumption and for unfairly rewarding large users. Supporters respond to the former by asking why anyone would purposely use more electricity than needed since such action would only increase the monthly bill. Higher energy costs in manufacturing would have to be included in product prices where they might reduce the ability to successfully compete with similar products. A valid question does exist, however, about the effects of lower KWH unit prices on the purchase of more energy efficient equipment. The issue of rewarding larger users has been defended by pointing out the lower cost of service (one meter, one billing, more efficient transmission) to larger industrial/commercial users as compared with private households.

Information Sources:

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, pp. 72-73
Washington, D.C.: Public Technology, Inc., 1975

Texas Environmental Coalition
"Energy Conservation and Utilities: The State of the Art - September, 1976", pp. 6-7
Citizen's Energy Conservation Seminar Series No. 2 (Mimeographed.)

Conservation Option: Flat Rate Structures

A flat rate schedule means that every KWH unit consumed is priced the same. Because of the rapidly increasing utility fuel costs in many parts of Texas, declining block rates have often become much more "flattened." Rate class defferentials (industrial, residential) usually are connected with a

flat rate structure.

Proponents of flat rates (with class differentials) argue that economies-of-scale are now so difficult to achieve that discounts for large users are hard to justify. Also, since large users are as likely to put a peak load demand burden on utilities as small users, the former should receive no advantage.

Opponents of the flat rate structure argue that this schedule forces large users to pay more than their share of customer and fixed costs. Without a minimum bill to cover these charges, small users could actually be subsidized by larger ones. One solution to this problem would be, technically, a declining block rate with only two blocks - one including the majority of costs of service for "average" users, the other applying to larger unit demands.

Information Source:

Texas Environmental Coalition
"Energy Conservation and Utilities: The State of the Art - September, 1976", pp. 7-8
Citizen's Energy Conservation Seminar Series No. 2 (Mimeographed.)

Conservation Option: Inverted Block Rate Structure

With inverted block rates, the price per KWH unit increases as consumption increases. A sample price schedule might be 3¢ per KWH for the first 40 KWH, 4¢ per KWH for the next 50 KWH, and so on. "Lifeline" rates - a much debated suggestion to provide the minimum supply of electricity for the necessities of life at an affordable cost for even the poor and persons on fixed-incomes - are a special case of inverted block rates.

Inverted block rates are highly praised for their emphasis on energy conservation. Arguments against this rate are that, again, service costs may not be covered in the lower blocks so that small users are subsidized by larger consumers. Also, it is pointed out that if the lower blocks are too underpriced as to actual costs, small users will not be encouraged to conserve. In fact, increased energy costs may force some industrial/commercial consumers out of the market or reverse economic growth by forestalling expansion plans. Utility revenues could also be very uncertain as the system's load factor might deteriorate.

Information Source:

Texas Environmental Coalition
"Energy Conservation and Utilities: The State of the Art - September 1976", pp. 9-11
Citizen's Energy Conservation Seminar Series No. 2 (Mimeographed.)

Conservation Option: Peak Load, Time-of-Day, or Seasonal Rates Structures

Electric generating systems must be designed to accommodate total demand, which fluctuates by hour of the day and season. "Peak loads" are those periods of highest system-wide demand; utility equipment idle at other times must then be operated to meet this demand. Under peak load rates, users requiring energy during these peaks are charged more per unit than at off-peak periods. Peak rates defined in terms of parts of a day are called "time-of-day" pricing; peak rates for particular periods of months are "seasonal" schedules.

Example: Time-of-day Rates

Many countries in Western Europe utilize time-dependent peak load rates to level peak demand and, thereby, reduce the need for expensive excess generating capacity. One class of users in France, for example, pays 1.4¢ per KWH at night and 9.6¢ per KWH during the day. Such a rate structure has also stimulated the development of residential heating storage units like those found in England whereby heat produced at night (off-peak rates) is stored in ceramic bricks for natural radiation heating during the day.

Example: Seasonal Rates

Wisconsin has a seasonal rate structure designed to reduce energy demand in the summer. Air conditioning has become widespread and produces a large summer peak. Therefore, summer electricity prices are almost 20 percent higher than in the winter. Texas is another excellent example of such summer peak loads.

There are several arguments against peak load rates. First, it is often difficult - or even impossible - for consumers to shift their demand to off-peak hours. Large industries with shifts working around the clock are a good example. Even storage devices in homes are limited solutions due to

their high efficiency losses. Seasonal shifts may be even more of a problem. Consumer attempts at conservation to avoid peak-hour consumption may produce sharp, short "needle peaks" - high demand that occurs when further restraint is impossible. Price differentials can also result in "shifted peaks" - the same high demand over the same length of time during a different period of the day. Other questions arise about the stability of utility revenues under this schedule and whether it offers any real reduction in the load factor or merely a shift.

Information Sources:

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, pp. 73-74
Washington, D.C.: Public Technology, Inc., 1975

Texas Environmental Coalition
"Energy Conservation and Utilities: The State of the Art - September 1976", pp. 12-16
Citizen's Energy Conservation Seminar Series No. 2 (Mimeographed.)

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City of Garland (pop. 126,189)

Garland owns its own utility, as do some 70 other Texas cities. All of its rates are declining block; there are, however, special riders available to a limited number of generally larger customers that deal with off-peak and all-electric space heating demand.

OFF-PEAK DEMAND RIDER

(currently applied only to a large, 3-shift manufacturing operation)

Availability: This rider is available for use only with demand rate GS-L and to customers averaging 1000 or more kW of actual demand during the most recent 12 months ending with the current month and HTS rates.

The provisions of the applicable rate are modified only as shown here.

Method of Charge: Off-peak conditions are defined as any of the following:

(a) between the hours of 9:00 p.m. and 3:00 p.m the following day, prevailing local time.
(b) Saturdays.
(c) Sundays.
(d) The following holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day as these holidays are specified in Public Law 90-363 (USCA Section 6103).

Off-peak demand increment is defined as the positive difference between the maximum demand, as determined by the applicable rate, which occurs during on-peak conditions subtracted from the maximum demand occurring in off-peak conditions.

Charges for the applicable rate will be modified as follows:

Charges will consist of the sum of two parts: the demand charge for the on-peak demand plus the demand charge for the off-peak demand increment.

The charge for the on-peak demand will be computed in accordance with the applicable rate, substituting the on-peak demand.

The demand charge for the off-peak demand increment will be computed as follows:

(1) All off-peak demand in excess of the on-peak demand, but less than 150% of the on-peak demand will be computed at the rate of $0.100 per kW.

(2) All additional off-peak demand in excess of 150% of the on-peak demand will be computed at the rate of $.60 per kW.

GENERAL SERVICE SPACE HEATING RIDER

(currently applied to only a grocery store and fast-food restaurant)

(1) Availability: This rider is available for use only in conjunction with Rate Schedule GS-S (Code 310) and GS-L (Code 314) where the customer's total space heating and cooling requirements are supplied exclusively by electric energy and where the customer has permanently installed electric space heating equipment totaling 2 kW capacity or more.

For this rider, space heating is defined as heating supplied from heat pumps and/or resistance-type electric heating units during the six (6) consecutive months beginning with the November billing period of each year. Tons of electric refrigeration capacity is defined as the standard rating conditions for cooling as defined by the Air-Conditioning and Refrigeration Institute.

Service under this rider at the City's option shall no longer be available for additional customers wherever the maximum kW capacity requirements of all customers of the City during any space

heating season equals 85% of the maximum kW capacity requirements of all customers of the City during the preceding summer months.

(2) Billing: During the space heating season service shall be billed each month in accordance with Option "A" or "B" as follows:

OPTION A: With customer's wiring arranged where total service can be metered and nonspace heating service can be metered, the energy during the space heating season for the operation of space heating equipment will be billed monthly as follows:

1.15¢ per kWh

Energy consumption of remaining load will be billed at regular rate. Option "A" shall not apply when nonspace heating equipment is connected to space heating circuits.

OPTION B: (Available to GS-L Code 314 customers only) Where existing customer's wiring is not arranged as set out in Option "A," the total service will be billed in accordance with the regular rate, except that during the space heating season the billing demand shall be adjusted. The billing demand during the space heating season shall be the kW supplied for all purposes during the period of maximum use as defined under the applicable rate schedule for the current month or during the immediate preceding summer months, whichever is greater, adjusted by deducting an amount equivalent to the following:

1.4 kW per rated ton to electric refrigeration capacity in comfort cooling equipment for the first 25 tons of capacity.

1.0 kW per rated ton of electric refrigeration capacity in comfort cooling equipment for all additional tons of capacity.

Provided, however, that the billing demand will not be greater than the demand for the current month.

(3) Payment, Contract Period, Fuel Adjustment Clause, Tax Adjustment Clause: Same as Rate Schedule GS-S (Code 310) and GS-L (Code 314).

For further information, contact:

George Humphries
Maintenance Manager, Electric Utilities
200 N. 5th
Garland, Texas 75040
Phone: (214) 272-2511

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Conservation Option: Mechanical Load Management

The Federal Energy Administration recommends the use of load management practices and technologies to improve the efficiency of electricity production and lower consumer costs by requiring the need for extra generating capacity. The combination of some form of peak-load pricing with mechanical load management has a very great conservation potential for all utilities.

There are several load management practices that can divert part of the peak load to off-peak periods by means of central, remote-controlled switching and regulation of meter functions. The following were described in the March, 1977, Energy Report to the States:

- Clock-activated time switches, generally used for water heater load control and meter register switching. Such switches are themselves relatively inexpensive; control schedule change, however, tends to be time-consuming and costly.
- One-way ripple systems, where signals can be sent over existing powerlines to sequence demand, phase off-peak users, and set meters for appropriate unit charges. These systems are currently used mainly for meter switching and control of water heaters, storage space heater loads, and street, shop window, and monument lights. Costs are higher than switches; the system must be considered in any power grid network expansion or change.
- Two-way ripple systems, in addition to performing the above tasks, can be used to automatically read meters, impose time-dependent rates, and monitor/control feeders. The main additional advantage of this system would be a reduction in utility data-handling operation.
- Radio signals can be used to cut off water heaters, especially in areas of high load density. This system is not an integral part of the power grid.
- Phone systems can be used to automatically read meters, sending the data over existing phone lines. Two disadvantages are incomplete coverage to homes without phones and the fact that regular phone service has priority.

Information Sources:

Federal Energy Administration
"Fact Sheet" Federal Intervention in State Regulatory Hearings," p. 2
October 1975 (Mimeographed.)

National Conference of State Legislatures
Energy Report to the States, No. 4, pp. 2-3
March 7, 1977

Conservation Option: Interruptible Service

Utilities may offer an interruptible service rider to certain customers, usually very large industrial concerns. If total demand exceeds a certain level, interruptible customers are cut off. To balance this possible curtailment, the customer receives a lower unit rate. Instances of interrupted service were very common in the severe winter of 1976-77.

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City of Garland
(pop. 126,189)

Garland's utility structure contains the following rider for curtailable (interruptible) service:

City of Garland, Texas
CURTAILABLE SERVICE RIDER

Availability: This rider is available for use only with demand rates GS-L and HKS and to customers agreeing to curtail, upon the utility's request, all or a portion of their total demand, but in any event, not less than 2,000 kW.

Hours of Curtailment: Hours of curtailment will be 3:00 p.m. to 9:00 p.m. Monday through Friday inclusive excepting New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day as specified in Public Law 90-363 (USCA Section 6103) but not exceeding 300 hours in any consecutive 12-month period. Hours of curtailment will normally be scheduled at least 30 days, but in any event, not less than 6 hours in advance.

Determination of Load Curtailed: The amount of load curtailed will be the positive difference of the highest demand established in the current month during the hours of curtailment subtracted from the highest demand established during the current month. During months when there is no curtailment the amount of load curtailed will be the average of the amounts of load curtailed during the preceding 11 months.

Credit Adjustment: Charges will be computed as provided for in the applicable rate. The Billing Demand will be the maximum demand as indicated in the applicable rate minus the amount of load curtailed as indicated above. After such computations a credit of $0.97 per kW of load curtailed will be made up to the total of the regualr demand charge.

For further information, contact:

George Humphries
Maintenance Manager, Electric Utilities
200 N. 5th
Garland, Texas 75040
Phone: (214) 272-2511

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Conservation Option: Cooperative Agreements with Other Municipal Utilities

Pooling and interconnection can offer several advantages to municipal utility systems. Joint purchase of fuel and additional power can give small city utilities substantial cost savings not otherwise possible through individual agreements. Pooling peak demands and an interconnected distribution network help reduce the need for individually-owned, expensive peak load generators and also provide supply security in case of generating capactiy loss. Installation of new equipment can also be better coordinated through such a system.

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City of Garland
(pop. 126,189)

A member of the Texas Municipal Power Pool, Garland combines its generating facilities with those of Denton, Greenville, Bryan, and the Brazos Electric Power Cooperative. This arrangement enables the four cities to pool their peak power demands and transfer power within the interconnected distribution network. Each member is thereby able to reduce its own expenditures for reserve generating capacity. Additionally, cooperative buying power and the distribution network enable members to use any of the system's plants to produce electricity and to buy fuel closer to the source. These factors have helped to hold the rates of the Texas Municipal Power Pool members at levels below those in many other areas of the state.

For further information, contact:

George Humphries
Maintenance Manager, Electric Utilities
200 N. 5th
Garland, Texas 75040
Phone: (214) 272-2511

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Information Source:

Lyndon B. Johnson School of Public Affairs
Energy in Texas, Volume I: Electric-Power Generation, pp. 5-9
Austin, Texas: University of Texas at Austin, 1976

Conservation Option: Utility Equipment Efficiency

Public Technology, Inc., reports that electric power plant efficiencies increased from 15 percent in 1900 to 33 percent in 1965 due to numerous technological advances. Since that time, however, average fuel conversion efficiency has declined as older, less efficient plants have been operated to meet rising peak load demands.

The most significant opportunities for improving efficiency arise as equipment must be replaced or capacity expanded. However, an in-house look at operating practices and maintenance schedules could reveal changes that would affect efficiency now.

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City of Jasper
(pop, 7,000)

In an effort to conserve energy, Jasper's power plant was studied for opportunities to increase operating efficiency. One major finding was that two plant engines could be rescheduled so that one ran at full load while the other was kept in reserve rather than operating at short load.
For further information, contact:

Wayne DuBose
City Manager
272 East Lamar
Jasper, Texas 79591
Phone: (713) 384-4651

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Information Source:

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, pp. 75-76
Washington, D.C.: Public Technology, Inc., 1975

208-A

Conservation Option: Customer Assistance

Customer assistance to all utility users - large and small - can help both the utility in reducing peak loads and the consumer in reducing unnecessary energy costs. Many municipal utilities include brief "energy tips" brochures in monthly billings or newsletters; several also make an effort to personally assist large customers in analyzing their operations to reduce consumption.

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City of Garland
(pop. 126,189)

About one-quarter of the 28,000 homes in Garland are total electric. Because such homes have higher monthly utility bills, Garland has initiated a unique program to assist these and other customers in reducing their electric bills.

The City contracted with a firm specializing in thermographic analysis to undertake a project called "Urban Thermographic and Land Use Analysis." Thermography employs a radiometric camera which senses infra-red energy or heat and translates a "heat picture" electronically to a video monitor or to an image on a photographic negative. The picture is mostly gray tones; contrast varies from black to white.

An aerial survey was done of the city on the coldest day of last winter by a plane flying at 1700 feet. The plane "mapped" the entire city using the radiometric camera. Poorly insulated buildings show up as gray or nearly white, indicating excessive heat loss.

This information will be valuable in many ways. At present, video tapes are being indexed so that city employees, trained to interpret the information, may consult with individuals and businessmen about their respective buildings. When the project is completed, a locator map will direct an employee to a video cassette image of a resident's home which can be displayed on a television monitor. If the image shows the home to be poorly insulated, information will be given to the homeowner on how to insulate the home. The utility company also does a computer reference check of a 15 month billing history which compares at least two of the seasons to indicate a pattern of high usage.

For further information, contact:

George Humphries
Maintenance Manager, Electric Utilities
200 N. 5th
Garland, Texas 75040
Phone: (214) 272-2511

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Conservation Option: Innovations in Conservation

The electrical utility industry has created a jointly-funded national research corporation to perform studies on crucial electrical problems. One major research focus is energy conservation for generation and transmission; techniques being studied include the following:

- Combined gas and steam turbines, capable of burning natural gas, oil distillates, or products produced from goal gasification. By using combined cycle systems, greater efficiencies can be achieved than by operating a gas or steam turbine engine.
- Magnetohydrodynamics, a process that directly converts energy to electricity by squirting hot, ionized (electrically charged) gas through a magnetic field. MHD techniques promise greater generating efficiencies as well as lower maintenance and cooling requirements.
- Turbulent fuel mixing, an experimental technique for mixing air with oil to achieve 99 percent combustion. At some future time this method may contribute to the reduction of fuel waste as well as air pollution.
- Cryogenic transmission, a laboratory method that used low-temperature technologies to increase the transmission efficiency of electricity. On a laboratory scale exceedingly high-distribution efficiencies can be achieved, but many problems stand in the way of practical application.
- Waste-heat utilization, the collection and use of waste heat dissipated from electric-power plants to supply the heating requirements of local residential and commercial structures.
- Total-energy systems, the design and construction of integrated utility packages that would supply electric power, heating and cooling, and liquid and solid waste disposal to residential complexes and shopping centers.

Information Source:

Lyndon B. Johnson School of Public Affairs
Energy in Texas, Volume I: Electric-Power Generation, p. 42
Austin, Texas: University of Texas at Austin, 1976

VII Alternate Energy Sources

VII: Alternate Energy Sources

Conservation Option: Energy Recovery From Solid Waste

Energy recovery from solid waste is a relatively new alternative made increasingly attractive by the growing shortage of sanitary landfills in highly populated areas, public concern over the location and presence of landfills, and the recent energy crisis. The potential of this option is made apparent by the fact that in the United States, $2.5 billion is spent annually in collecting and transporting urban refuse; about $700 million is, additionally, spent for its disposal.

The Resource Recovery Act of 1970 enabled the Federal Solid Waste Management program to assist states and municipalities by assuming part of the risk of trying new technologies. The result was a significant expansion of the Federal resource recovery program.

One part of the program was the recovery of energy by burning shredded residential solid waste as a supplemental fuel in power plant boiler furnaces. This process was initially studied by the City of St. Louis and the Union Electric Company with financial support from the Federal Solid Waste Management program. In 1970, a demonstration phase was initiated when the U.S. Environmental Protection Agency's Office of Solid Waste Management Programs and Office of Air Programs jointly awarded a grant to the City of St. Louis for two thirds of the cost of that city's project.

The firing of refuse as a supplemental fuel in utility boilers is the basis of the St. Louis project. Domestic solid waste collected from residential areas of the City is ground up in a large hammermill. The shredded wastes are air classified, and the light combustible waste is fired pneumatically into boilers where it is burned in suspension with pulverized coal.

Magnetic metals are recovered from the heavier, mostly non-combustible materials. The remaining glass, ceramics, and other nonmagnetic materials are landfilled.

The St. Louis demonstration resource recovery project recovers two products - fuel and ferrous metals. In addition, flyash and bottom ash are sold by the Union Electric Company to a local cement manufacturer. Ferrous metals are sold to the National Steel Corporation.

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City of San Antonio
(pop. 800,000)

In 1973, the City of San Antonio undertook a feasibility study to analyze the composition and heat content of its solid waste as a potential supplemental fuel for use in generating electricity by its publically owned electrical utility, the San Antonio City Public Service Board. Originally, the City had considered using its solid wastes as supplemental fuel in two new 418 megawatt lignite power plants to be constructed south of San Antonio.

The solid waste was to be used to produce 5% of total BTU's with lignite coal providing the remaining output. To insure the coal supply, the City purchased 100 coal cars and contracted with Sun Oil Company on a 30 year basis to bring lignite coal to San Antonio from mines near Gilette, Wyoming.

The first solid waste project feasibility study was entitled "Survey of San Antonio Solid Waste For Composition and Heat Content." It examined, on a day-by-day and seasonal basis, the City's supply of solid waste. As a second step, a cost feasibility study was undertaken by the San Antonio Public Service Board. Its findings were announced in late spring, 1977; the cost of the project was prohibitive and consequently has been discontinued.

One of the most significant differences between the San Antonio proposal and the St. Louis project was that San Antonio did not receive any outside funding for the heavy front end costs of installing equipment for shredding the wastes and separating the ferrous/non-ferrous metals and combustible materials. The St. Louis project received two thirds of its funding from the Environmental Protection Agnecy's Office of Solid Waste Management.
For further information, contact:

Tom Ivy
Municipal Utilities
P.O. Box 9066
San Antonio, Texas 78285
Phone: (512) 277-3211

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Information Sources:

Southwest Research Institute
Survey of San Antonio Solid Waste For Composition and Heat Content
San Antonio, Texas: Southwest Research Institute, 1973

U.S. Environmental Protection Agency
Energy Recovery From Waste
Washington, D.C.: U.S. Government Printing Office, 1972

U.S. Environmental Protection Agency
Energy Recovery From Waste: Solid Waste As Supplementary Fuel in Power Plant Boilers
Washington, D.C.: Government Printing Office, 1973

Conservation Option: Usable Energy From Municipal Wastewater Treatment

It is estimated that there are 1,343 wastewater treatment plants in Texas, 164 of which operate anaerobic digestion facilities. Of these 164 plants, the most common means of digester gas disposal (ranked in order) are open-air burning, digester heating, and power generation.

To date, no treatment plants in Texas utilize anerobic digestion and energy conservation to the fullest potential. Fort Worth approaches maximum utilization and is the best source of useful, practical information on gas generation and usage.

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City of Fort Worth
(pop. 409,868)

The following narrative on Fort Worth's wastewater treatment process at Village Creek was written by Irvin H. Nelson, Assistant Director for Treatment.

FORT WORTH WATER DEPARTMENT
SEWAGE TREATMENT DIVISION

VILLAGE CREEK WATER POLLUTION CONTROL FACILITIES
NARRATIVE

The wastewater of the major population of Tarrant County is conveyed through 1,358 miles of pipelines. These vary in size from six to ninety-six inch diameters.

Wastewaters reach the Village Creek Plant site at the confluence of Village Creek and the Trinity River by means of a ninety-six inch line and a fifty-four inch line. This site is at one of the lower elevations of Tarrant County, allowing gravity flow. The plant serves portions of other adjacent communities.

The wastewaters are measured and screened initially, The screenings are removed to a burial site. The screened flow is subjected to a short sedimentation period of some 3.5 minutes. During this period, the heavier organic and inorganic materials settle to the bottom of the detritors or grit removal units. This sediment is moved to a peripheral sump by means of rotating scraper arms.

The slurry is removed from the sump by means of timer programed torque-flo impeller pumps. Pumpage is to a hydraulic centrifugal separator in which the slurry is "washed". The organic materials are separated from the inorganic in this manner. The water and accompanying organic material is returned to the flow while the inorganic is moved to a storage hopper by means of a walking beam conveyor. The grit may be removed from the hopper to a waiting truck for transport to the burial site.

The wastewater is conveyed to settling tanks where the waters remain for some 60 minutes. The portion which settles to the bottom is removed by program timed telescoping valves. The slurry flows by gravity to a pump station from whence it is pumped to another gravity thickener for resettling. The clarified liquid flows over the top of these six tanks and is collected in a receiving well for transportation to secondary (aeration) treatment. The liquid is pushed up the hill by pumps capable of lifting 10,500 gallons (4,378 tons) per minute. Two of these pumps are variable speed allowing for flexibility necessary to handle the varying flows. (A sleeping community contribures little wastewater.)

The fluid portion still contains food for microorganisms since not all could be removed by sedimentation. This food is combined with microorganisms which must have air in order to live. The air is in turn supplied by the combustion of the gas (produced by other organisms) in the 440 HP engines which turn rotating air compressors. The engine cooling systems are in the form of heat exchangers. These compressors supply air to the bottom of the seventeen foot deep aeration tanks. There the food and microorganisms are stirred with and by the air, as the fluid moves through the tank in a sprial fashion for some six to eight hours.

The microorganisms are then well-fed, and like any well-fed being, need to relax and digest their food. The flow from the aeration tank is conveyed to the final sedimentation tanks where the well-fed microorganisms (in two hours) do in fact fall through the water to the bottom of the tanks. This leaves a clear water which overflows the tank and goes into the Trinity River, returned once more to nature as a useful product.

The microorganisms from the final settling tanks are returned to the aeration tanks ready and hungry to get back into contact with the food (clarified wastewater and air). A portion of these microorganisms may also be sent to the thickener or to anaerobic (gas producing) tanks to assist in producing more gas.

The settleable solids from the primary and final sedimentation tanks are sent to the thickener where the solids are concentrated into a thickened slurry. This thickened material is then pumped to a closed environment known as digesters. The liquid overflow from the thickener returns to the influent of the primary settling tanks.

Microorganisms which originated within warm blooded animals utilize the food value of the sludge to produce gas (fuel) and a fertilizer which is pumped to lagoons for drying. During the thirty days the slurry is in the digesters, practically all of the useable food value is converted to energy (gas). The microorganisms function most efficiently at a temperature of 98° F, therefore this temperature is maintained in the digesters; in this way heat from the gas engine cooling water is utilized.

It is interesting to note that 60% of the total energy to operate this plant is produced from 0.6% of the total flow into the plant. As a matter of reference, the wastewater from one person (one hundred gallons per day) will produce a cubic foot of combustible gas having about 600 BTU's.

In conclusion, note that the working microorganisms are of two types (aerobic and anaerobic). These little creatures were not added to the flow as it entered the plant. There were already in the wastestream. The various stages of the plant simply created suitable environments for their proliferation. Also note that there is a never ending cycle which is taken to economic advantage. To wit: solids and microorganisms are combined to produce gas in one (air deficient) environment. The gas is used in turn to compress air which aids in the growth of more organisms (in air) which may be returned to the digestion units for producing more gas and so ad infinitum. The engine cooling water aids in keeping the microorganisms warm in order to produce more gas.

A portion of the treated now clear water is returned to the plant to assist in engine cooling, yard watering, pump cooling and washdown.

For further information, contact:

Irvin H. Nelson
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Fort Worth Water Department
P.O. Box 870
Fort Worth, Texas 76101
Phone: (817) 335-7211

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Conservation Option: Solar Energy for Buildings

The applied use of solar energy is more technically feasible than ever and is becoming even more progressive. Existing solar systems are marketed for moderate temperature applications such as domestic water and space heating. The majority of systems are not designed for the purpose of converting solar energy into electricity. Such a process is technically possible, but its economics are yet competitive with more common energy sources.

Most solar systems include piping, heat exchangers, ducts, pumps, and fans - the same components that have always been used for heating and cooling but put together in different ways. While solar heating and cooling systems cost virtually nothing to operate, their construction and installation involve significant amounts of capital. Principal costs involve the collectors and the thermal-storage system that must be sized to accomodate not only the sun's diurnal cycle (day and night) but also periods of extended cloud cover. The key to solar utilization for space conditioning is in collector cost and performance.

For the most part, unsubsidized solar energy must compete with conventional energy sources which are subsidized by the national government. A tax credit would encourage investments in solar heating and cooling. To this date, the federal government has not approved any tax credits regarding solar energy although several states have provided such an incentive on their own income taxes.

To control the mechanical quality of solar installations, the International Association of Plumbing and Mechanical Officials (IAPMO) passed a resolution at their 46th Annual Business Conference to develop a basic solar energy document. The first edition of the resulting Uniform Solar Energy Code was officially adopted by IAPMO in September, 1976.

* * * * * * * *

City of Mansfield
(pop. 6,050)

The Mansfield Independent School District has constructed and put in operation a 1500 seat auditorium with a solar heating and air conditioning system. The building was funded entirely by the school district at a cost of $48,000 above a conventional HVAC system and has a proposed 6.5 year payback period.

One hundred forty-one trough solar collectors line the south roof surface of the structure and turn east to west by a system of weights and pulleys with the diurnal cycle of the sun. Copper tubing circulates the water through the collectors for heat transfer, accumulating a 400° average. The hot water circulates to four large underground tanks with 15,000 gallons capacity each. The hot water runs generators for heating and for chilling the water for the air conditioning system. There is a forty hour reserve of heating and cool-

ing. The building does have a small gas operated HVAC back up unit for emergency use.

The building is used for all types of school and community functions which require auditorium facilities.

For further information, contact:

Willie Pigg
Superintendent of Schools
Mansfield Independent School District
609 E. Broad
Mansfield, Texas 76063
Phone: (817) 473-1178

* * * * * * * *

Information Source:

"Solar and Geothermal Energy", pp. 86-88
Chemical Engineering, January 3, 1977

Conservation Option: Solar Heating for Municipal Swimming Pools

On November 1, 1976, Los Angeles County, California, passed a law which banned the use of natural gas to heat swimming pools. Since almost 90% of all pools in California are heated with gas, this created a major problem.

Los Angeles began testing solar heating devices to meet this challenge. In March, 1977, the giant Salazar pool became the first municipal facility to use solar collectors. Its plastic collector panels can heat 58° water to an 80° temperature in one day. A 20-horsepower pump lifts pool water to solar panels set atop a nearby building. Total cost, including labor, was $19,243; the 150 collectors alone cost $4,088. The city manager estimates the system will save 1.3 million cubic feet of gas each swimming season, a $1,500 savings.

California's International Swim Center at Santa Clara uses $30,000 worth of natural gas each year. Solar heating will cut this bill in half.

Example: Spring Park Racquet Club, Richardson, Texas

In 1975, work started on a bathhouse roof solar installation at the Spring Park Racquet Club. With 600 sq. ft. of collection surface, the system provides water heated to a temperature of up to 190° F for two showers in the

bathhouse, six showers in the nearby racquet clubhouse, and to the development's swimming and wading pools. Because the project was experimental, its cost ran to $12,000. The system architect, Mr. John Gosling, believes that other similar systems would cost less because certain problems have been ironed out at Spring Park and because the prices of flat plat collectors are expected to eventually decline. The solar installation is considered a model for municipal pools in the state.

Information Sources:

Federal Energy Administration
Energy Reporter August 1976

"Bathhouse Roof Acts as Collector at Spring Park", p. 3
Solar Engineering January 1976

Special Information Source: National Solar Heating and Cooling Information Center

The National Solar Heating and Cooling Information Center was established by HUD in cooperation with ERDA under P.L. 93-409 to assist in increasing the awareness of the practical feasibility of solar energy and to encourage the public, industry, and governmental agencies to consider solar systems for homes and commercial buildings.

Information on HUD and ERDA sponsored solar demonstration projects nationwide is available through the Center. In most cases, the Center can answer questions immediately or foreward printed information. Besides acting as a referral point and resource center, the Center maintains a mailing list providing current, continuing information about solar energy. A speakers list and exhibits for seminars are also available.

In addition, the Center distributes grant applications for HUD and ERDA solar demonstration projects and gives specific information regarding the appropriate times to make grant requests.

For further information, contact:

National Solar Heating and Cooling Information Center
P.O. Box 1607
Rockwall, MD. 20850
TOLL FREE Phone: 1-800-523-2929

Conservation Option: Geothermal Energy

The Energy Research and Development Administration has set a goal of bringing 20,000 to 30,000 megawatts of commercial geothermal generating capacity on line by 1985. Presently, the only large-scale geothermal power generating complex in the country is the Geysers Fields, 80 miles northwest of San Francisco in California. Its current electrical output is 502 megawatts with plans to expand this capacity to 908 megawatts by 1979.

There are two forms of geothermal energy: dry and wet steam. Dry steam, the more rare form, occurs when hot water boils in an underground reservoir; some of the resulting steam condenses on surrounding rock, the remainder reaches the surface. Dry steam can be used in a turbine without the need of a boiler.

Yellowstone National Park is an example of "wet steam" geysers. This steam is created when underground water is heated by surrounding rock to the boiling point but remains liquid because of high underground pressures. This superheated water flows to the surface (when wells are drilled in the right places) in a mixture of 10-20 percent steam with hot water. The steam must first be separated from the hot water before it can be used to turn a turbine. Wet steam is now being used in New Zealand and at the Cerro Prieto Field in Mexico. In these cases, hot water is used to heat another liquid with a lower boiling point (for example, isobutane) which turns the generator. A number of the "wet steam" areas are located in the United States, chiefly in the West.

"Geopressured systems" are reservoirs of water trapped far underground at high pressures, usually mixed with natural gas. There is a belt of such reservoirs running 750 miles along the gulf coast. The chief drawback of utilizing these areas for energy production is the lack of knowledge about the longevity of such reservoirs, which causes a reluctance to invest large amounts of capital in their development.

Hot, dry rock is found near the surface in large areas of the world, including a large part of the American West. The U.S. Geological Survey has classified 1.8 million acres of land in the West as "known geothermal resource areas." To tap such sources, it is proposed to drill a hole deep into the rock formations, fracture the rock, pump water down, and withdraw the heated water through another hole. The heat would then be extracted to

generate electricity.

Geothermal resources, for the most part, lack technical procedures because they have been looked on as an uninteresting form of energy in the past. A more vigorous effort at research and development must occur before their benefits can be utilized.

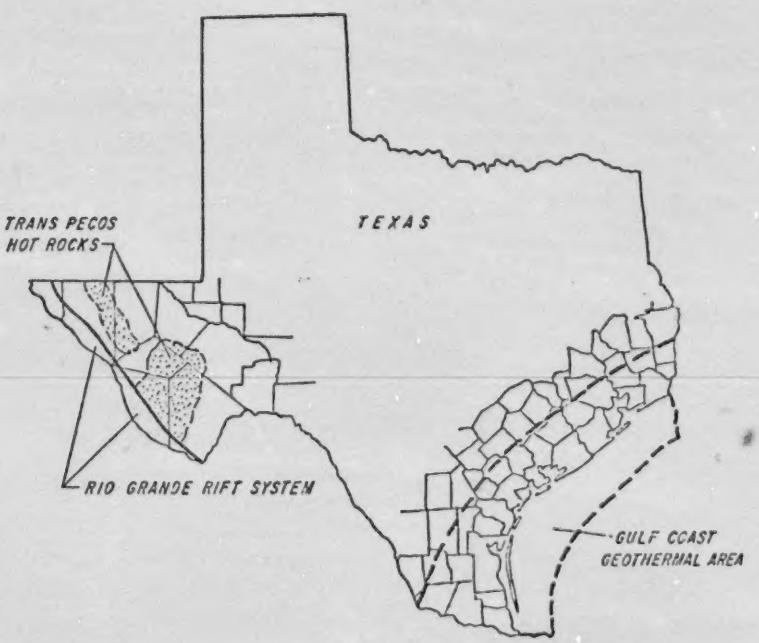
* * * * * * * *

Geothermal Energy in Texas

Texas, a leader in oil and gas production, is also a potentially large producer of exotic resources.

Hot rocks, geysers, and geopressured energy sources all exist in Texas and are particularly encouraging for development of electrical power. The map in Figure 7.1 indicates the three areas of the state thought to have geothermal potential. Of the three, the Gulf Coast offers the greatest potential for short range production.

Figure 7.1



Information Sources:

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Texas Energy Report, Number 10
January 1975, pp. 13-15

Energy Research and Development Administration
Technical Information Center Publication
Geothermal Energy
Washington, D.C.: U.S. Government Printing Office, n.d.

VIII Other Conservation Options

VIII: Other Conservation Options

The attempt in this manual has been to classify conservation options by functional areas rather than any departmental structure. It was hoped that this broader system would overcome problems of widely varying city structures and division titles while promoting conservation thinking on a city-wide scale, i.e., all public vehicles (whether police, fire, or administrative) and all public buildings (whether offices, garages, or libraries). Because some areas of municipal services do not fit neatly into functional areas, however, the following potpourri of conservation options is included.

Conservation Option: Swimming Pool Chlorine

In July 1976, the price of chlorine experienced an enormous increase. Due to this price increase, an alternate method of treating swimming pool water was "reintroduced" during the swimming pool seminars held by the Texas Department of Health Resources, Region 5.

Iodine's history as a water disinfectant dates before the turn of the century. Since the enormous "boom" in swimming pool construction - coupled with the large increase in the price of chlorine - iodine is again being used as a sanitizer. The main advantages of this process are:

- Reliability and lack of irritation
- More stable than hypochlorous acid (the killing power of chlorine) when exposed to ultraviolet light
- Not used up with organic matter in the pool
- Does not form nitrogen compounds analagous to the chloramines
- Far less volatile than chlorine with less tendency to escape from the pool with high temperatures
- Disinfecting power not affected significantly by pH. Iodine does not change pH of pool.
- Does not react with amonia to produce iodamines
- Does not bleach hair or swimming suits
- Eye irritation almost non-existant
- Pools can be sanitized at one-third to one half the cost of chlorine

The 1970 Pool Service Technician's Handbook and HEW's Swimming Pools - Safety and Disease Control Through Proper Design & Operation both present very good "lay"descriptions of this chemical program.

Information Sources:

Texas Department of Public Health, Region 5
1526 N. Cooper
Arlington, Texas 76010
Phone: (817) 265-2438

National Swimming Pool Institute
Pool Service Technician's Handbook, pp. 48-49
Washington, D.C.: National Swimming Pool Institute, 1970

U.S. Department of Health, Education, and Welfare
Swimming Pools - Safety and Disease Control Through Proper Design and Operation, pp. 64-65
Washington, D.C.: U.S. Government Printing Office, 1976

Conservation Option: Street Lighting

Public Technology, Inc., reports that street lights consume less than one percent of the energy demanded nationwide each year. While this figure is small, energy conservation options in this area very visibly show a city's commitment to reducing unnecessary waste/cost.

Street lighting serves the purposes of traffic safety and pedestrian security. For this reason, any option reducing the level of overall illumination should first consider the following factors:

- Type of route - roadway or walkway
- Type of development along the route
- Physical features of roadway
- Traffic accident history/experience
- Street crime experience for area
- Other security requirements

Based on these elements, the Illuminating Engineering Society recommends certain average maintained horizontal illumination levels.

Roadway and Walkway Classification	Commercial		Intermediate		Residential	
	Foot-candle	Lux	Foot-candle	Lux	Foot-candle	Lux
Vehicular Roadways						
Freeway*	0.6	6	0.6	6	0.6	6
Major and Exway*	2.0	22	1.4	15	1.0	11
Collector	1.2	13	0.9	10	0.6	6
Local	0.9	10	0.6	6	0.4	4
Alleys	0.6	6	0.4	4	0.2	2
Pedestrian Walkways						
Sidewalks	0.9	10	0.6	6	0.2	2
Pedestrian Ways	2.0	22	1.0	11	0.5	5

* Both mainline and ramps.

Note: The recommended illumination values shown are meaningful only when designed in conjuction with other elements. The most critical elements, as described in Design of Roadway Lighting and Pedistrian Walkway Lighting, are as follows:

(a) Illumination Depreciation
(b) Quality
(c) Uniformity
(d) Luminaire Mounting Heights
(e) Spacing
(f) Transverse Location of Luminaires
(g) Luminaire Selection
(h) Traffic Conflict Areas
(i) Border Areas
(j) Transition Lighting
(k) Alleys
(l) Roadway Lighting Layouts

Options for street lighting fall into two groups: existing lights and replacement lamps. To reduce energy use for existing lights, many cities have simply turned off some part of the lighting system, e.g., every second light.

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City of Wichita Falls
(pop. 102,000)

In 1973, Wichita Falls decided to conserve its energy use by reducing

excessive street lighting. Some 310 luminaries (400 and 1,000 watt sizes) were deactivated on expressways and major thoroughfares by cutting off one of the two lamps on each median mounted pole. Estimated savings at that time were 880,000 KWH annually or $14,500, an amount equivalent to the annual electrical use for sixty average homes. The program continues today with even greater dollar savings at higher electrical rates.

For further information, contact:

Gerald Fox
City Manager
P.O. Box 1431
Wichita Falls, 76307
Phone: (817) 322-5611

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Lights have also been put on automatic controls such as photocells to reduce operation during hours of sufficient natural light or on pre-set timers to completely turn off the lights in late evening or early morning. Properly scheduled lighting maintenance and relamping with lower wattage lamps will also aid conservation efforts.

An alternative growing in popularity with many cities is the replacement of existing street lights with high efficiency mercury or sodium vapor lamps. As noted in the manual section on lighting for public buildings, such lamps use significantly less energy to achieve the same lighting level, making them a cost-effective option. At least one city, however, found citizen opposition to the pinkish orange glow cast by sodium lamps; mercury lamps were more "acceptable" because of their white light.

Information Sources:

Public Technology, Inc.
Energy Conservation: A Technical Guide for State and Local Governments, pp. 78-79
Washington, D.C.: Public Technology, Inc., 1975

Illuminating Engineering Society
IES Lighting Handbook, 5th ed., p. 20-6
New York: Illuminating Engineering Society, 1972

Conservation Option: Recreational Lighting

As with other lighting applications, certain standards exist for illumination levels at recreational events. Cities may find the following selected IES guidelines useful in planning for public parks, swimming pools, and other recreation facilities. Energy savings can, once again, be realized by reducing excessive illumination, proper maintenance of existing luminaries, and installation of high efficiency mercury or sodium vapor lamps.

AREA	Footcandles* on Task	Dekalux** on Tasks
Baseball:		
Recreational -		
Infield	15	16
Outfield	10	11
Junior League (Class I and II)-		
Infield	30	32
Outfield	20	22
On seats during game	2	2.2
On seats before/after game	5	5.4
Basketball-recreational:		
Outdoor	10	11
Bathing beaches:		
On land	1	1.1
150 feet from shore	3	3.2
Golf:		
Tee	5	5.4
Fairway	1,3	1.1,3.2
Green	5	5.2
Driving Range		
at 200 yards	5	5.4
over tee area	10	11
Gymnasiums:		
Exhibitions, matches	50	54
General recreation	30	32
Assemblies	10	11
Lockers, shower rooms	20	22
Softball:		
Recreational (6 pole)-	10	11
Infield	7	7.5
Outfield		

AREA	Footcandles* on Task	Dekalux** on Tasks
Swimming (outdoor):		
Exhibitions	20	22
Recreational	10	11
Underwater - 60 lamp lumens per square foot of surface area		
Tennis (outdoors):		
Tournament	30	32
Club	20	22
Recreational	10	11

* Minimum on task at any time for young adults with normal and better than 20/30 corrected vision.
** Dekalux is an SI unit equal to 1.076 footcandles. 1 dekalux = 10 lux.

Information Source:

Illuminating Engineering Society
IES Lighting Handbook, 5th ed., pp. 9-91 - 9-94
New York: Illuminating Engineering Society, 1972

Conservation Option: Mosquito and Weed Control

Mosquito and weed control are major summertime concerns in many Texas cities. Traditionally, control chemicals have been mixed with diesel fuel. With rising fuel prices, however, several Texas cities have begun using water-based mixtures.

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City of Wichita Falls
(pop. 102,000)

In September of 1973, the Wichita Falls Health Department changed its mosquito spraying chemical from one which utilized diesel fuel for a mixture to one which does not. This has saved the city as much as 20,000 gallons of diesel fuel annually.

For further information, contact:

Gerald Fox
City Manager
P.O. Box 1431
Wichita Falls, Texas 76307
Phone: (817) 332-5611

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City of Moody
(pop. 1,500)

Moody formerly used a weed killer chemical mixed with diesel fuel for spraying operations. The mixture has been changed to chemical and water, resulting in a savings of 500-600 gallons of diesel fuel annually.
For further information, contact:

Harvey Pittman
City Administrator
P.O. Box 68
Moody, Texas 76557
Phone: (817) 853-2314

* * * * * * * *

Conservation Option: Non-Chemical Mosquito Control

In communities with ponds in recreational parks, creeks, marshes, or large natural areas of brackish water, the seasonal control of the Anopheles mosquito is a considerable man-hour and insecticide expense. An article in Texas Parks & Wildlife Magazine suggests an alternative mosquito possibility - the use of Gambusia minnows.

> Mosquito control methods such as the spraying and/or draining of wet lands have been tried, but most of these techniques prove detrimental to the environment...Spraying therefore, in many areas has been discontinued and flooding encouraged, thus making the mosquito controlling Gambusia of prime importance. (p. 14)

It is believed that stocking these areas with the Gambusia fish would be a natural, inexpensive, almost one-time investment type of mosquito vector control.

Information Source:

Bob Fish
"Gambusia", pp. 14-15
Texas Parks and Wildlife
December 1976

Conservation Option: Sludge as Fertilizer

City sewage departments produce large amounts of dried "sludge" as an end-product of treatment. Some cities find it profitable to sell this sludge as a fertilizer to other areas; all should consider using it on city-owned property for lawn and flowerbed maintenance.

* * * * * * * *

City of Fort Worth
(pop. 409,868)

The Fort Worth Water Department Sewage Treatment Division allows the City's Parks Department to haul sludge from two of its treatment plants for use on city parks and grass meridians. The sludge is a very high organic compound with little odor, ideal for use as a fertilizer. While sludge does not meet all fertilizer needs, its use saves considerable park monies. For further information, contact:

Irvin Nelson
Assistant Director for Treatment
Fort Worth Water Department
P.O. Box 870
Fort Worth, Texas 76101
Phone: (817) 335-7211

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Appendix

TML TEXAS MUNICIPAL LEAGUE
1020 Southwest Tower Austin, Texas 78701 (512) 478-6601

May 2, 1977

Dear City Official:

The availability of energy and energy-related products is of major interest to Texas cities. Ultimately, the problems of public sector energy use and policy enforcement will be at the doorstep of City Hall.

The Institute of Urban Studies, The University of Texas at Arlington, is conducting a statewide survey of municipal energy conservation practices (see attached questionnaire). The survey results will be a valuable source of information to Texas cities in meeting the demands of energy management.

Your cooperation in completing and returning this questionnaire is appreciated. A copy of the survey results will be published and timely made available to you.

Sincerely,

Dick Brown

Richard D. Brown
Executive Director

RDB:am
Encl.

Municipal Energy Conservation Survey

This statewide survey of Texas communities is designed to update the "state-of-the-art" in Texas energy conservation. Since the last IUS energy survey in 1974, local officials have expressed their continuing need for more detailed conservation information to assist community efforts to lower energy costs while providing an adequate level of basic municipal services. It is hoped that the results of this conservation project will go far in meeting these needs.

Please answer as many of the following questions as possible. The survey has purposely been kept brief. Project staff members will later contact cities with especially interesting or unique conservation programs for more detailed information.

Please return the survey in the enclosed self-addressed envelope no later than June 3, 1977. If you have questions, please contact Ms. Jaci Walker or Ms. Martha DeHaven, Institute of Urban Studies, (817) 273-3071.

Name of City:_____ Estimated Population:_____

Name of Person Completing Survey:_____ Phone:_____

1. Has your city council or commission adopted a policy statement concerning energy conservation? Yes ( ) No ( )

   *If yes, please attach a copy to this survey.

2. Has your city designated an Energy Conservation Coordinator or otherwise given responsibility for municipal conservation to a specific individual?
   Yes ( ) No ( )

   *If yes, is this person employed by the city or is he/she a citizen volunteer?
   Employee ( ) Volunteer ( )

   *If yes, please provide this person's name, official title, and business phone for future contact during this project:

   Name:_____

   Title:_____

   Business Phone:_____

   *Could we use this person's name and phone as a reference in our published conservation manual? Yes ( ) No ( )

3. Does your city have a conservation committee composed of interested citizens?
   Yes ( ) No ( )

   *If yes, how is this committee selected? Elected ( ) Appointed ( )

   *If yes, please briefly list their duties:

4. Has your city received federal or state grants that have aided your conservation efforts in any way? Yes ( ) No ( )

*If yes, please list the name(s) of the federal/state program involved:

5. The following are general areas in conservation for municipal services. Please check those areas in which your city is actively involved in conservation efforts:

- ☐ Comprehensive energy management planning
- ☐ Energy audits for buildings and/or services
- ☐ Computerized energy management information systems
- ☐ Employee participation plans (carpools, conservation contests)
- ☐ Purchasing policies for energy efficiency
- ☐ Periodic energy use reports by department
- ☐ Efficient operation of public buildings
- ☐ Efficient use of public vehicles (maintenance, routing, fuel dispensing)
- ☐ Public works construction/maintenance (scheduling, new techniques/supplies)
- ☐ More efficient traffic control techniques (signal timing, special lanes)
- ☐ Police/fire department efficiency programs
- ☐ Community information and involvement activities
- ☐ Use of alternate energy sources (solar, methane from garbage)
- ☐ Utilities management

*If your city has any especially interesting or unique conservation activities, please briefly list them below:

6. To aid our own search for published materials or persons with special expertise in conservation, please list any sources of information that have been particularly helpful in your city's conservation efforts. If your city has published any conservation materials of its own, we would greatly appreciate copies for our project files.

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Some of the information sources used in this manual may not be found in public or even university libraries. To aid Texas city officials who desire further details but cannot find a particular resource at their library, mailing addresses for direct contact with the information source are included in this bibliography.

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1700 Las Lomas NE
Albuquerque, New Mexico 87131
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1717 Massachusetts Avenue NW
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New York, New York 10017

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P.O. Box 19069
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5032 Alhambra Avenue
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Sid Richardson Hall
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1970 Chain Bridge Road
McLean, Virginia 22101

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Washington, D.C. 20014

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